Motivation and Achievement in Science:
A Study of Junior Secondary School Chinese Students in Hong Kong

Mei Lee CHAN
M.Sc., PGDE, B.Sc.

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ABSTRACT

While there is ample evidence that motivation is associated with student academic performance in western countries, few research efforts have examined the relationship between motivation and Science achievement for junior secondary Chinese students in Hong Kong. There is a need to investigate whether previous findings from western cultures are relevant to the Hong Kong Chinese culture. This study investigated the relationship between motivation and achievement in junior secondary Chinese students in relation to the compulsory academic subject of Science in Hong Kong. Employing a sample consisting of 1,000 Chinese students from seven schools, the study investigated differences in motivational patterns across school year levels. Key variables examined in exploring this relationship were year level, age, type of school and gender.

The results found indicated that science motivation in junior secondary students was generally lower for older students as was Science achievement. This was particularly evident for female students. Form 1 students showed significantly lower degrees of negative motivation in relation to learned helplessness, but higher degrees of positive motivation in terms of self-efficacy beliefs, learning goal and attitude towards Science than did the Form 3 students. Meanwhile, the Science achievement grade in Form 1 students was significantly higher than that for Forms 2 and 3 students.

The study found two principal relationships between motivation and achievement in Science: a negative correlation between Science achievement and negative motivation, and a positive correlation between Science achievement and positive motivation. The poorer the Science achievement, the higher were the degrees of learned helplessness. In contrast, the better the Science achievement, the

higher were the degrees of science self-efficacy, learning and performance goal orientations and positive attitude towards Science. It is suggested that performance goals might serve a facilitative function in enhancing motivation because they were found to correlate positively and significantly with learning goal, self-efficacy, attitude towards Science and Science achievement. Self-efficacy beliefs were identified as the major predictor for Science achievement while other motivational dimensions were also significant. Science achievement significantly predicted all the motivational dimensions. Furthermore, there was a clear gender difference in motivation in the Science domain. The lower levels of motivation in the older groups were most apparent in females. They demonstrated significantly lower science self-efficacy, levels of learning goals, performance goals and attitude towards Science than males. They also exhibited significantly higher levels of learned helplessness. This apparent lower motivation in junior secondary females should raise a concern in science education in Hong Kong.

The most interesting finding of the study was that the results demonstrated that the junior secondary Chinese students in Hong Kong displayed similar motivational patterns to many western students, particularly in the United States (e.g., Anderman & Maher, 1994; Anderman, Maher, & Midgley, 1999; Nicholls, 1979). These findings may help science educators to consider that the Chinese junior secondary students in Hong Kong might behave similarly (at least on those five constructs) to students in the United States. These understandings can accelerate the development in modelling theories and supporting work for science education in Hong Kong. Cultural issues are presented which may help to explain the findings reported. Implications for promoting self-efficacy and a positive attitude towards school Science in Hong Kong are discussed.

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CHAPTER ONE

INTRODUCTION

Background of the Study

Cultural Beliefs in relating to the Achievement of Hong Kong Chinese Students

Culture applies a significant influence on the ways people think and behave. A number of studies (e.g., Bond, 1983; Fyans *et al.*, 1983; Maehr, 1974) suggest that the value of achievement is culture specific and this can significantly influence students' achievement values. Chinese children are typically raised under the influence of Confucian philosophy that emphasises effort, hard work, diligence and persistence (Yang, 1986). Effort is considered an important determinant of success in the Chinese culture (Hau & Salili, 1996), with academic performance being seen as largely determined by how much effort students devote in studying. Children learn to put effort on tasks even when these are unlikely to prove successful. Many Chinese proverbs put an emphasis on the significance of effort rather than ability. Some of the examples translated by Lin and Leonard (1998) include, *Tian cai zai yu qin fen* (天才在於勤奮, which means "Genius comes from diligence"), *Cheng gong shi san fen tian cai qi fen nu li* (成功是三分天才七分努力, which states "Success is three parts genius and seven parts hard work"), *Zhi yao gong fu shen, tie chu mo cheng zhen* (只要功夫深, 鐵杵磨成針, which says "You can turn an iron pillar into a needle if you work hard enough"), *Shui di shi chuan* (水滴石穿, which states "Constant dripping water wears away the stone, constant effort brings success"), and *ren you heng xin wan shi cheng* (人有恆心萬事成, which means "Perseverance will

guarantee success"). In Chinese society, people who make an effort to achieve tasks beyond their capability are greatly admired (Hau, 1992). Perseverance and effort are considered as a key to solving problems. They are encouraged by some popular Chinese proverbs. Two of the examples translated by Lip (1984) include, *Tian xia wu nan shi, zhi pa xin bu zhuan* (天下無難事,只怕心不專, which says "Nothing is difficult if one preserves. Perseverance is the mother of success"), and *Bu shou ku zhong ku, nan wei ren shang ren* (不受苦中苦,難為人上人, which means "If you have not endured the most difficult, you cannot become the most successful. Great tests lead to great successes"). These proverbs promote effort as a key to the attainment of knowledge and to the achievement of success. Chinese children learn that it is possible to develop study skills and improve their abilities by putting effort (Salili & Hau, 1994).

Cultural background is an important factor influencing students' motivation (e.g., Bond, 1983; Hau, 1992; Maehr, 1974; Stevenson & Lee, 1996; Yang, 1986; Yu, 1980). Cultural background differences can foster various beliefs and values in the causes of success and failure (Ho *et al.*, 1995). Chinese students may apply different approaches to achievement because of the influence of cultural values (Ho *et al.*, 1995). Hofstede (1980, 1991) postulates that the most prominent distinction between western countries (including U.K. and U.S.) and Chinese societies (including Hong Kong) is the individualism and collectivism dimension.

Collectivism has significant role for achievement in the Chinese culture. Chinese culture possesses a strong sense of collectivism and face consciousness that may motivate the Chinese people to succeed (Wilson & Pusey, 1982). Yang (1988) portrays two characteristics of Chinese achievement motivation: (1) success is for the

benefit of a group rather than the individual; (2) the label of achievement is usually defined by other people rather than the individual. Because of collectivistic values, Chinese parents see academic success as a significant basis of pride and academic failures as stigmatising for the whole family (Stigler, Smith, & Mao, 1985), and Chinese students are motivated to achieve because they do not want to bring shame to their family. In particular, the Chinese mothers usually have high expectations of their children's performance (Hess, Chang, & McDevitt, 1987). Chinese students are motivated to achieve because they do not want to bring shame to their family. As a result, Chinese students might feel pressure from cultural expectations to achieve academically. They may even consider their studies as representing a duty to their parents (Stevenson & Lee, 1990). Family and group targets have higher importance and priority than those of the individual (Hui, 1988). In a comparative study between collective and individual failure situations by Yu (1980), Chinese students did not provoke the need for achievement because of individual failure; however, they significantly improved their responses to the need for achievement in collectivistic situations. Striving for individual success might not even be meaningful to the Chinese students because of their collective value. However, the younger generations of Chinese students in Hong Kong are being influenced by modernisation and adopt more western cultural and individualist ideas (Yu & Yang, 1987). Consequently, they have created their own culture from the elements of Chinese traditions and modern western cultures.

The population of Hong Kong consists of many immigrants from China. After World War II, the Hong Kong population was about 500,000 people. In 1947, the population became 1.8 million. Within one year between 1949 and 1950, around 776,000 Chinese refugees migrated to Hong Kong (Endacott, 1964). In 1961, Hong

Kong's population had already reached to 3.16 million. Among the population, 50.5% of the people were born in China, 47.7% were born in Hong Kong and 1.8% were born in other countries. In other words, around half of the population was Chinese immigrants. In 1972, the Hong Kong government implemented a policy to control illegal immigrants entering Hong Kong. After that policy was implemented, most of the younger generations have been born and raised in Hong Kong. Although ethnic Chinese comprise approximately 95% out of 6.9 millions of the Hong Kong population in 2006 (C&SD, 2007), Hong Kong was under British colonial rule for over 150 years prior to the handover in 1997. The long political separation from Mainland China, handover of sovereignty, national unification, international impact and globalisation, has influenced the values and attributes of the Hong Kong Chinese people (Ghai, 2001; Hong *et al.*, 1999). After being ruled by the British for 150 years, the majority of Hong Kong Chinese identifies themselves as Hongkongers more than Chinese (Lau, 1997; Lau & Kuan, 1988). In particular, the adolescents in Hong Kong have distinctive attributes and values, and might see themselves as more sophisticated and modernised than the mainland Chinese (Lam, *et al.*, 1999).

Despite the western influences, the heritage of the Chinese culture has built a firm foundation in the life of Hong Kong people. Under these influences, students in Hong Kong might have distinctive Hong Kong Chinese culture in achievement motivation, which is an interest for this present study. Even though many researchers have investigated achievement motivation in western countries, only a few studies have been conducted with Hong Kong Chinese students. Murphy and Alexander (2000) argue that since most of the research on motivation related to academic achievement has been performed in western cultures, there are reasons to question the generalisation of its conclusions and implications to other cultures.

There might be concerns regarding on their generalisability into a broader cultural population. Whether any of the previous findings from western cultures are relevant to Hong Kong Chinese culture is open to questions. One of the objectives in this study is to address this concern. Thus, this study investigates the relationships between motivation and achievement in the cultural contexts of Hong Kong Chinese students.

The Significance of Education in Hong Kong

The importance of education stands out remarkably in the Confucian conceptions (Giles, 1972; Ho, 1986; Wu, 1989; Yang 1986). Succeeding in examinations in the ancient Chinese has been rooted for selection purposes. Examining procedures were already in place in 1,100 B.C. (Zhang, 1988), and a national examination and selection system has been maintained since the Sui dynasty (AD 581-618), approximately 1,500 years ago in China (Bond, 1996). The purpose of the examinations was to select capable scholars from all over the country to serve in civil positions (Bond, 1996; Zhang, 1988). Although only a very small percentage of the candidates were able to succeed in gaining appointments (O'Neill, 1987), many scholars persisted in attempting with hopes of becoming government officials because civil officials obtaining some remarkably desirable rewards associated with wealth, fame, upward social mobility and beautiful wives. These rewards are reflected in some popular Chinese idioms, such as, "The house built in gold can be found in books, the lady whose countenance is fair as jade can also be found in books" and "Although studying anonymously for ten years, once you are successful, you will become well-known in the world". Examinations have promised a good future and have motivated Chinese students to keep studying for a long time throughout history.

Today, the utilitarian value of education in Hong Kong has surged upward even more because of the globalised economy during the past decade. This has become a solution for individuals in obtaining social security and the society in achieving prosperity. Many are concerned about losing jobs from the economic downturn and impacts of globalisation as the consequence of competitive global markets. Hong Kong must improve its competitiveness by fostering a competent and educated workforce. The future prosperity and competitiveness of Hong Kong appear to rely on two key factors. The first factor depends on children's development of knowledge and skills. The other factor falls on the individuals and institutions that are responsible for educating and training children in Hong Kong.

Competition in the labour force has increased during Hong Kong's economic downturn in recent years. Level of education has determined employment opportunity. It has become extremely important to attain a higher level of educational attainment. According to labour force statistics, the unemployment rate was 2.2% in 1997, in 2000, the rate rose to 4.4%, and by 2003, the rate hit a 20-year high of 7.9% (C&SD, 2003). Youth between the ages of 15 and 19 years of age suffered the most. In 1997, their unemployment rate was 10%, but by 2002, the rate hit a 20-year high of 30.7%. The situation did not improve in 2003 and 2004 (C&SD, 2005). This has made it very difficult for teenagers to find a job. The unemployment situation may cause many adolescent problems, such as delinquency, suicide and drug abuse (Bessant, 2002). People in Hong Kong are worried about the economic situation. Parents are expressing concerns about the employment situation for themselves and the future of their children. With Hong Kong shifting towards a knowledge-based economy, the only hope for the adolescence to succeed in the

future is for them to achieve higher levels of education. The growing demand for education achievement has made Hong Kong an interesting case for this study.

Science in the 21st Century

Having examined the value of education in Hong Kong, the next issue this chapter will address is the significance of science and how science influences people's daily activities in the 21st century. The implications of science and technology affect our health, environment, education, career, economy and future. In the last two decades, the global status of science and technology has increased their significance. Individuals with a broad and deep education in science and technology will have a higher chance of success as our world experiences rapid science and technological development in the 21st century. For example, biotechnology and computer sciences are prominent areas. In this fast changing economic world, many business corporations and enterprises are entering into the stock markets by highlighting their innovative science and technology. The pharmaceutical and biotechnology companies caught the world's attention by developing immunisation to deadly diseases or medical breakthroughs in DNA therapy. The products and services from large computer corporations, such as Intel, Microsoft, Google, Yahoo, eBay, Dell, IBM, Oracle, Cisco, and Sun Microsystems, have become widespread in our daily activities. NASDAQ Biotechnology Index and Computer Index were established in the United States in November 1993. Over 160 companies were classified in the NASDAQ Biotechnology Index (NASDAQ, 2006a) and 560 companies in the NASDAQ Computer Index in November 2006 (NASDAQ, 2006b). Some of the founders in those companies were young scientists without much capital when they started up their businesses.

The Hong Kong government has been extensively promoting and implementing science and technology in the education, business and industry sectors in the past two decades. With the vision in science and technology, Hong Kong government planned in advance to open up a new university to meet the new demands of skilful work force as early as 1986. After only five years of construction, the Hong Kong University of Science and Technology (HKUST) was open to students. HKUST was ranked number 17 internationally in *Times Higher Education Supplement* league table in technology in October 2006 (HKUST, 2006). Another outstanding example should go to the Innovation and Technology Fund with an initial injection of US$0.6 billion on more than eight hundred approved innovative projects in six years since November 1999. Furthermore, the Hong Kong Science and Technology Parks were also constructed by the Hong Kong government in May 2001 to support the needs of the fast changing high technology industries in Hong Kong. Science is turning into an essential subject for young learners in Hong Kong not only in terms of academic aspects, but also in economic terms and to employment opportunity. Thus, the motivation of Hong Kong junior secondary school students in science is an interest for this study.

The Pyramidal Structure of Education System in Hong Kong

The goals of the Hong Kong education system are to provide and support students in reaching their full potential and preparing for their future (EDB, 2007), and thus in creating a better and more prosperous Hong Kong society. The education system established was similar to the one in the United Kingdom because Hong Kong was under British colonial rule for over 150 years prior to the handover in 1997. However, many changes have been made since the 1990's. A historical

cornerstone for Hong Kong education was inaugurated in 1981. Students began to receive nine years of free compulsory education from Primary 1 up to Form 3 (Year 9), or until they turn fifteen years old. During these nine years, students pass through three allocation systems. At the age of six, students start their "free" journey by going through the Primary One Admission (POA) system. At the age of eleven, they pass through the second gate – the Secondary School Places Allocation (SSPA) system for junior secondary education. They are allocated to one of three different bands of schools based on their academic attainment. Band One schools are the top academic achieving schools in Hong Kong, while Band Three schools are the lowest academic achieving schools. At the end of compulsory education, students participate in the third allocation mechanism, the Junior Secondary Education Assessment (JSEA) system, for the selection of those students who are regarded to have "ability" and "according to their academic performance" to receive subsidised Form 4 (Year 10) places or post Form 3 training places (see Appendix I). In Form 3, students compete for a limited number of available subsidised school placements in the Form 4 year level. Form 4 students are usually about 15 years old. The majority of Form 4 students remain at the same school and enrol in the 2-year Certificate of Education (CE) programme. A public examination, commonly known as the Hong Kong Certificate of Education Examination or HKCEE, is administered to Form 5 (Year 11) students at the completion of the CE programme. Their HKCEE public examination results will determine if they qualify for the Form 6 (Year 12) year level enrolment. Pre-university courses were introduced as a standardised 2-year programme to the qualified Form 5 graduates. After completing two years of senior high school education, Form 7 (Year 13) students take an Advance Level public examination (HKALE) to compete for limited local university placements. The

HKALE is the primary target of many schools. It is considered to be the only gateway to obtaining a local university education.

Even though the Hong Kong government has been allocating almost a quarter of the annual total government expenditure on education (between 22.9% and 24% from the year 2003 to 2006, approximately US$5.8 billion) (EDB, 2006b), the current education policy provides government subsidised senior high school education to only one-third of the Form 5 day school graduates. In 2006, around 47,000 out of 120,000 students attained the minimum requirement of HKCEE results for Form 6; however, there were only 25,000 government-funded places available because there were 75,000 day school graduates (Clem, 2006; Clem, Tong, & Hui, 2006). In other words, a total of 95,000 students failed to receive the government subsidy for senior high school education in 2006. In addition, almost 7,000 day school students failed every subject (Clem, Tong, & Hui, 2006). After five years of secondary education, these students achieved no qualifications. Student enrolment at different education levels showed a trend of substantial decrease in the number of students between primary and senior secondary education in the academic years of 2000/01, 2004/05, and 2005/06. Table 1.1 shows the statistical figures for student enrolment from primary education to senior secondary levels. Figure 1.1 illustrates the trend of substantial decrease in student enrolment between primary and senior secondary education. The number of primary students increased from 49% to 60% to continue their junior secondary education. Averaging 63.5% of the junior secondary students continued their secondary education. About 37.5% of the Form 5 students continued their senior secondary education. Both HKCEE and HKALE public examinations are detrimental to their higher education and career opportunities because these examinations are used in the university selection process

and also for certification purposes. Approximately only one out of seven students progressed from primary to senior secondary education in those academic years. Only a small fraction (about 6% or 7%) of the students continue their subsidised tertiary education. A large proportion of the young people did not pass and became early school leavers. Under this survival-of-the-fittest competitive education system, students may feel intense pressure to be one of the fittest for academic achievement.

Table 1.1 *Student Enrolment in Hong Kong*

Student Enrolment	2000/2001	2004/2005	2005/2006
Primary	493,979	447,137	425,864
Form 1 to 3	241,616	253,619	254,879
Form 4 to 5	155,518	160,916	161,901
Form 6 to 7	59,559	59,519	61,660
Total	950,669	921,191	904,304

Source: EDB, 2006a

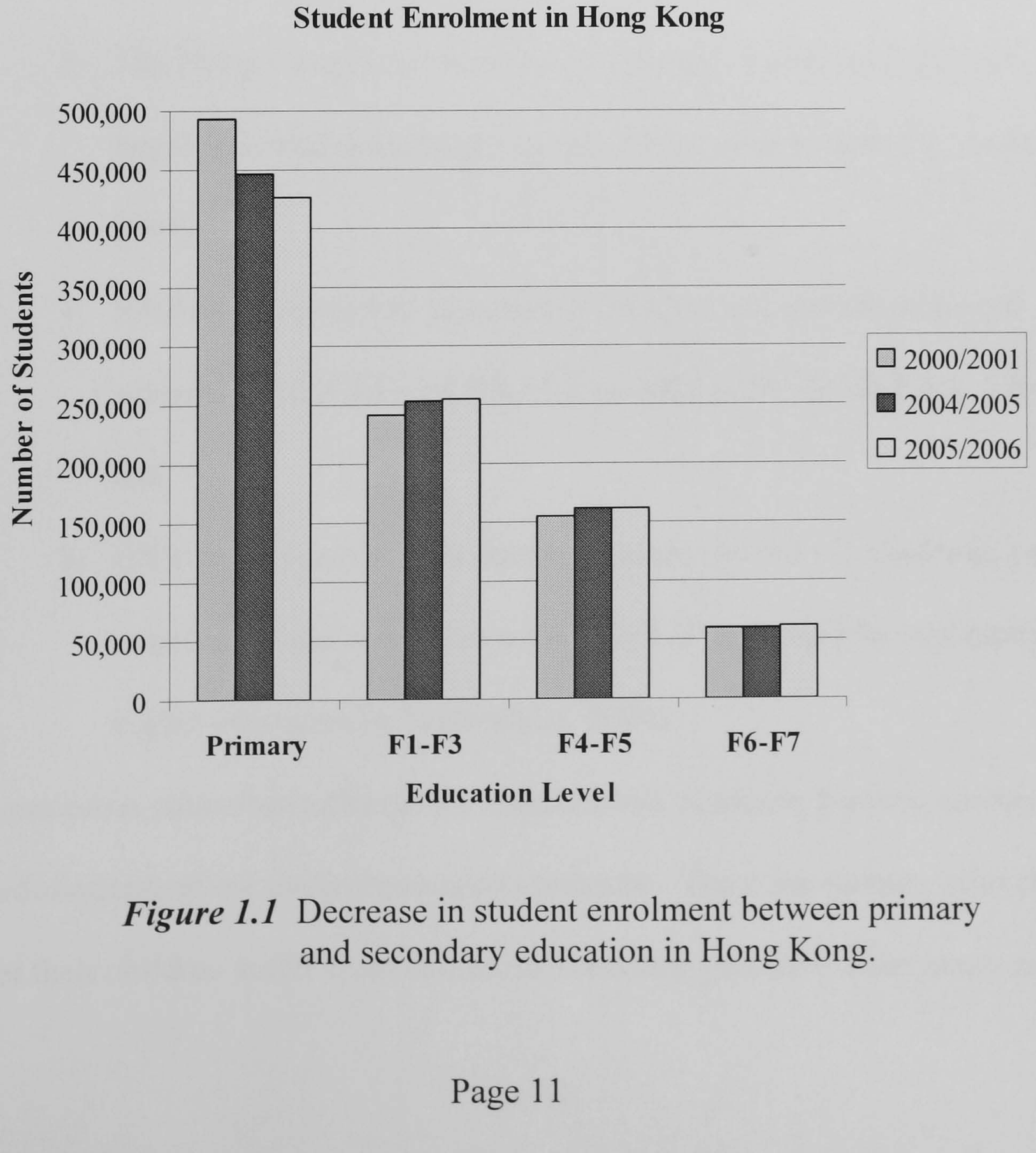

Figure 1.1 Decrease in student enrolment between primary and secondary education in Hong Kong.

Reviewing the problems in this pyramidal education system, the Hong Kong Education Bureau (EDB) has undertaken many different reforms to lessen the pressure for students, and improve teachers' quality by rapidly changing the educational system since the 1990's. The following are some of the reform highlights:

1. "Firm Guidance" in Medium of Instruction (MOI) policy: The less competitive schools were forced to change from English medium of instruction (EMI) to the mother-tongue (Cantonese) as the teaching instruction medium in 1998 (ED, 1997);
2. Compulsory SBM implementation: Education Commission commanded all public-funded schools to begin implementing school-based management (SBM) by 2000 in the Education Commission Report No. 7 (EC, 1997);
3. The Hong Kong Examinations Assessment Authority (HKEAA) began benchmarking language proficiency assessment for teachers in 2001;
4. HKEAA proposed to launch new subjects and abolish some old subjects in HKCEE and HKALE in 2007 (CDC & HKEAA, 2004); and
5. EDB announced in 2004 that the current '3+2+2+3' academic year structure would move into a new '3+3+4' structure for secondary and higher education in 2010 (EMB, 2004).

Facing numerous education reforms, the stakeholders, students, parents, teachers and school administrators are under tremendous pressure. There are parents, who choose not to let their children suffer from enormous schooling pressure under many new

education reform policies as "guinea pigs", who would rather give up their children`s "free" education and pay high tuition fees for a quality education experience. Parents perceive international schools as being more privileged and are not affected by the new education reforms. An alternative to the expensive international school route, the direct subsidy scheme (DSS) schools are a popular option. DSS schools have more freedom in the admission of new students, in choosing their own medium of instruction, and financial management including salary and school facilities. This new trend of perceptions about DSS schools leads to more students enrolling in the international schools and DSS schools, which strengthens the establishment of international schools, and encourages more government-aided schools to convert to DSS. A summary of comparisons among private independent schools, government-aided schools and DSS schools is provided in Appendix II (EDB, 2006c).

Motivation as an Obstacle in Junior Secondary Schools

Significant evidence from research (e.g., Eccles *et al.*, 1993b; Simmons & Blyth, 1987; Simmons & Rosenberg, 1975) show declines in motivation from the context of school structure across transition. Studies indicate that decreases in motivation during adolescence are not just a part of pubertal development, but relate to a range of contextual factors (Eccles & Midgley, 1989; Simmons & Blyth, 1987). Studies (e.g., Eccles *et al.*, 1993b) suggest that classroom and school environments highlight certain factors that play a role in many of the motivational problems during adolescence. A mismatch between the student and school environment is likely to happen during adolescent periods (Eccles *et al.*, 1993b). For example, there might be a developmental mismatch between the psychological needs of adolescent students and the kinds of environments that majority of schools provide (Eccles *et al.*, 1993b).

Excessive rules and discipline, weak teacher-student relationship, homogeneous grouping by ability, not enough opportunities for students to make significant decisions and stricter grading systems than those in the primary schools are characteristics of the traditional junior secondary school environment (Eccles *et al.*, 1993a; Eccles & Midgley, 1989). On the other hand, early adolescence is in the period of socio-cognitive development. Pupils need a strong sense of social interaction, self-determination and independence (Eccles & Midgley, 1989; Simmons & Blyth, 1987). As a result, the contexts of traditional junior secondary schools provide young people with different psychological needs. This mismatch may be responsible for the major decline in motivation frequently observed at this stage.

The declines in motivation indeed are a root for serious concern. It might lead to a potentially disturbing development in the future. The critical drop in motivation during the junior secondary school years might cause long-term effects throughout life (Eccles *et al.*, 1993b). For example, developing an aversion to reading in junior secondary school years may lead to weak language skills, potentially excluding a wide range of career interests before the adolescent is wise enough to choose. Thus, junior secondary school years may have important and enduring effects on determining career and life choices.

Purpose of the Study

Galloway *et al.* (1998) argues that the main influence on students' behaviour is school more than family background. A number of studies have indicated that motivation in junior secondary school students drops after transferring from elementary schools (e.g., Anderman, Maher, & Midgley, 1999; Nicholls, 1979). Will the pattern of lower motivation also happen in the junior secondary Chinese students? Are the motivational patterns distinctive in different year levels, types of schools and gender in Hong Kong? What motivational factors relate to science achievement in these students? Are there any major predictors for science achievement? Conversely, does science achievement have predictive power on motivation in science?

Studies (Catsambis, 1995; Eccles *et al.*, 1993b) argue that girls in junior secondary school years experience a larger decline in motivation than boys. For example, girls may take less advanced science courses in high school if their interests and attitude towards science have declined. As a consequence, they sometimes fail to meet university entrance requirements because they lack the required science background. Their decline of motivation may affect their choices for future education and careers (Anderman & Maehr, 1994). Various studies have established evidence that motivation is associated with student academic performance (e.g., Abramson *et al.*, 1989; Au, 1995; Eccles, Midgley, & Adler, 1984; Galloway *et al.*, 1998; Nicholls, 1989). Generally most studies observe males outperform females in science (e.g., Beaton *et al.*, 1996; Martin *et al.*, 2000; Martin *et al.*, 2004) in secondary schools. However, some studies found no significant gender differences in science achievement, or females outperform males (e.g., Catsambis, 1995; Lee & Burkam, 1996). Hence, this study also examines if there are any gender differences

in Hong Kong Chinese junior secondary schools in science achievement, motivation, and attitude towards science in the 21st century.

According to the Hong Kong Education Bureau, only one out of seven students advanced from primary to senior secondary education, and approximately two out of three junior secondary students continued their secondary education in the academic years of 2000/01, 2004/05, and 2005/06 in Hong Kong (EDB. 2006a). Thousands of students are dropping out of secondary education every year in Hong Kong. There is concern about how students face academic failure because academic failure puts students at risk of developing learned helplessness. Without remedial help, these students would experience more academic failures over time as they continue developing learned helplessness. Hong Kong is likely to have these problems because there is a high failure rate on traditional norm-referenced assessment for junior secondary students. Early academic failure may ruin these young students for the remainder of their schooling. The aim of this study is to examine the motivational aspects of Chinese junior secondary students in Hong Kong. Suggested further action and research are proposing that if the government should provide motivational intervention schemes, e.g., motivation retraining programmes, to help students develop positive motivation and to reduce the number of early school leavers. On the basis of the previous research, the main purpose of this study is to investigate the relationship between motivation and Science achievement of the junior secondary students, particularly of Form 1 (Year 7) and Form 3 (Year 9) Chinese students in Hong Kong.

Organisation of the Dissertation

This dissertation is organised into six chapters. Chapter one presents a broad overview of socio-cultural, economic, educational and psychological contexts that motivates this dissertation research. Chapter two reviews frameworks of motivational theories and causal attribution for achievement adopted in this study. Chapter three explains the research questions, hypotheses and methodology implemented in the study. Chapter four and five report the results from statistical data analysis. Chapter four emphasises the descriptive statistics among participating schools and students, and the measurement of the research questionnaire. Chapter five is organised around the research questions and hypotheses of this study. Chapter six concludes the findings with discussions, implications and limitations of this study. It also highlights the need for formulating motivational intervention programmes in Hong Kong.

CHAPTER TWO

LITERATURE REVIEW

Introduction

How is it when several people face the same task, they can react so differently? Why do some seek challenges, value effort and persist in the face of obstacles, whereas some avoid challenging tasks and easily give up in face of difficulty? Suggested explanations from different reviews for such kind of questions show various perspectives on motivation related to achievement. Motivation explains why people believe and behave as they do, and determines people's thoughts and actions (Weiner, 1992a). Motivation, with its various purposes and definitions, affects people's performance. Motivation theorists endeavour to explicate an individual's choice of achievement tasks, vigour in performing those tasks, and persistence on those tasks (Eccles, Wigfield, & Schiefele, 2002). Research over the last three decades has revealed that academic successes and failures are influenced by individual beliefs (e.g., Bandura, 1986; Abramson *et al.*, 1989). When motivation includes people's competence, it is achievement motivation (Nicholls, 1984).

Motivation is critical to academic achievement (Maehr & Archer, 1987). Researchers have employed a number of theoretical frameworks and empirical assumptions to identify a group of motivational factors affecting academic achievement (e.g., Bandura, 1986; Dweck, 1986; Eccles *et al.*, 1983; Meyer, 1980; Nicholls, 1984). Although there are many theories of achievement motivation, the conceptual framework in this study focuses on several motivational perspectives that involve perceived competence and cognitive processes in achievement settings.

They include self-efficacy, achievement goal orientations and learned helplessness. These constructs are found significant in relation to achievement by many researchers. Self-efficacy construct is a central component of social-cognitive model that refers to an individual's self-beliefs in his or her perceived competence to performance specific tasks (Bandura, 1997). Achievement goal orientations, both learning and performance goals, are viewed as part of the social-cognitive model of achievement motivation that links to perceptions of competence, and endeavour or avoidance to achievement-relevant outcomes (Dweck, 1986; Dweck & Leggett, 1988; Elliot, 1997). Learning goals focus on developing mastery and competence, whereas performance goals focus on demonstrating competence. The learned helplessness theory focuses on cognitive processes (Abramson *et al.*, 1978; Seligman, 1975) of the perceived inability to control future outcomes that link to deterioration in performance following failure. In addition, self-efficacy has high degrees of importance as a key factor influencing individual attitudes and behaviour (Bandura, 1978). Therefore, attitude towards the subject of Science is also examined in this study. By understanding the relationships between motivational factors and achievement, science educators may have ideas to develop effective student learning contexts and developing teaching methodologies to enhance motivation and, as a result, raise science attainment of junior secondary school students.

This chapter will begin with an examination of a range of concepts of motivation and achievement, including attribution beliefs, in particular, the role of ability and effort in motivation of Hong Kong Chinese students. The last section of this chapter presents key motivational theories and related concepts in relation to achievement employed in this study in more detail.

Concepts of Motivation and Achievement

Sockett's (1988) idea of education articulates a fundamental premise about the role of motivation, "Education is, at least, the endeavor to get people to do things they could not previously do, to understand things they did not previously understand, and perhaps, to become the people they did not expect to become" (p. 195).

Motivation can provide some insights about how to improve academic achievement. Hidi and Harackiewicz (2000) point out that lack of effort and lack of ability are two of the problems for unsatisfactory performance (Hidi & Harackiewicz, 2000). Why do some students not put effort in their school work? Why do some students have a perception of low ability in performing academic tasks? In examining causes given for outcomes, attribution theory provides insights about detrimental or conductive beliefs in explaining this question: "Why do people do what they do" (Alderman, 2004, p. 27). The following section will discuss the nature of attribution theory, the roles of perceived ability and effort in motivation, and cultural values related to the achievement approaches of Chinese students in Hong Kong.

Attributional Beliefs and Academic Achievement

Attribution beliefs in achievement motivation are referred to as the "perceptions of the cause of achievement outcomes" (Stipek, 2002, p.63). A causal attribution is "an inference about why an event occurred or about a person's dispositions or other psychological states" (Weary, Stanley & Harvey, 1989. p.3). Attribution theory involves a person's beliefs about the causes for success or failure at a task and how those beliefs affect expectations and behaviour (Heider, 1958; Weiner, 1992b). Weiner and his colleagues (1971) hypothesise four dominant causes in achievement-related perceptions: an individual's ability to accomplish the task.

level of difficulty of the task, degree of effort expended, and extent to which luck predisposed the outcome, determine what people infer about causality regarding success or failure. They initially proposed that there are two primary dimensions: locus of causality and stability. The locus of causality dimension concerns the extent to which the cause is associated to the characteristics of the individual. An external locus refers to other people or an external environment (e.g., task difficulty or luck). An internal locus originates within the individual (e.g., ability and effort). The temporal nature of a cause is the dimension of stability, which can be constant or changeable over time. A stable cause is considered as a long-term element which occurs in the past and will occur again sometime in the future (e.g., typical effort and ability). An isolated fluctuating cause is an unstable element (e.g., attention and immediate effort). Weiner (1979) subsequently included a third central dimension, controllability. The third dimension is a measure of the perceived influence available for a cause. Controllable causes are those which are under the control of the individual, whereas uncontrollable causes are not. Internal and external locus could be either controllable (e.g., effort) or uncontrollable (e.g., task difficulty, luck and sickness).

Weiner's (1986) three dimensions (locus, stability and controllability) are illustrated in Table 2.1. Each dimension starts as a bipolar continuum. They are labelled at the extremes with the phrases internal-external, stable-unstable, and controllable-uncontrollable. Discrete categories such as external or internal are assumed for this study. These three dimensions construct a total of eight causes for success or failure in achievement settings. For example, one can fail because of internal causes such as low ability or lack of effort, or external causes such as a biased instructor or friends who fail to help. These attributional properties are

important to identify specific reasons for success and failure, different ways of viewing reasons, source of beliefs, and factors influencing change in expectations. Another more important reason, Weiner (1992b) describes, "Knowing why one has failed might increase later chances for success because pertinent instrumental actions can now be undertaken" (p. 19).

Table 2.1. *The three dimensions of causal attribution: Locus X Stability X Controllability of the perceived causes of achievement success and failure.* Adapted from Weiner (1986, p.51)

Dimension	Controllable		Uncontrollable	
	Stable	***Unstable***	***Stable***	***Unstable***
Internal Locus	Typical effort Example: • I've improved because I've consistently studied over the last year.	Immediate effort Example: • I did better than I expected. I studied that week to pass the test.	Ability Example: • I did well because I'm smart. • I did poorly because I'm dumb.	Sickness/mood/ fatigue (the day of the task) Example: • I was sick last week and couldn't study for the examination.
External Locus	Stable condition Example: • The instructor is biased. • The instructor explains well.	Unstable condition Example: • I got a good grade because my friends helped me. • I did well because the test was easy.	Task difficulty Example: • Mr. Jones always gives us difficult tests.	Luck Example: • I was lucky to pass the test because my guesses on the multiple-choice questions were mostly correct.

Dilemma in the Role of Ability and Effort

As children approach adolescence, they are more likely to see ability as a stable, internal attribute and less correlated to effort than they did in the elementary school (Nicholls, 1989; Nicholls & Miller, 1985). Concern with ability and worries about failure are a widespread generalised problem which may have a pervasive impact on students. Many students often attribute academic achievement to ability

rather than effort, and prefer to increase their sense of worth by comparing ability with others rather than to make personal progress in learning (Covington, 1992: Nicholls, 1989). They try hard to maintain positive perceptions of their competence and self-esteem. These results demonstrate that students tend to choose achievement-oriented activities when the opportunity comes up (Atkinson, 1964). When a student studies hard for a test but fails, the student may interpret himself or herself as lacking competence. In other words, making an effort on school tasks might carry risks – a threat to one's self-worth (Covington, 1992). Covington (1998) depicts the role of effort and ability as a "double-edged sword" in the implication that a student with lower ability needs to apply more effort while the application of high effort implies low ability of students when success is not reached. Nicholls (1989) argues that when ability is considered as capacity, it may enhance the effect of effort on achievement. At the same time, the effect of effort is controlled by ability. Effort can increase performance only up to the limit of individual's current capacity. When performance is equal, higher effort implies lower ability. Furthermore, Nicholls (1989) points out that lack of ability can be judged when one cannot do what others can. In other words, an individual's capacity is revealed as low or high relative to the abilities of others. Students' own concepts of ability and effort have important effects on their motivation and achievement. Numerous studies found that the students who are not able to compete satisfactorily for grades are anticipated to have motivational problems (e.g., Abramson *et al*, 1989; Galloway, 1998; Nicholls, 1979; Seligman 1975). Their low achievement and chronic failure may lead them to believe that they simply do not have sufficient ability to succeed in school. As a result, they may be inclined to drop out of school (e.g., Abramson *et al*, 1989; Nicholls, 1979), if not physically, at least, psychologically (Nicholls, 1989).

Motivational Theories in relation to Achievement

To understand students' motivation in Science, it is important to explore the main motivational theories adopted in this study, and demonstrate how their theories provide theoretical and empirical frameworks which enable an examination of motivation and Science achievement. A number of motivational theories are discussed in this study, including self-efficacy belief, achievement goal orientations and learned helplessness. Attitude towards Science is also included in this study because it has important impact on achievement motivation.

Self-Efficacy Belief

Self-efficacy concerns people's beliefs in their capabilities to achieve particular results by their own actions (Bandura, 1997). The belief that people have in their ability to achieve desired results is a basis for action. Self-efficacy beliefs are hypothesised to contribute to people's motivation in several ways: their choices in the course of action, the amount of effort they put into tasks, the length of time they will persist when they face obstacles and failures, and resistance to failure (Bandura, 1993; Schunk, 1991). People may believe that their action may bring about certain outcomes; however, they may not believe that they have the ability to make their desired results happen. According Bandura (1997), "perceived self-efficacy is concerned not with the number of skills you have, but with what you believe you can do with what you have under a variety of circumstances" (p. 37), and "self-belief does not necessarily ensure success, but self-disbelief assuredly spawns failure" (p.77). Compared with people who have low self-efficacy, people who have higher sense of self-efficacy belief perform a task more readily, work harder, persist longer in face of difficulties, and accomplish higher levels of achievement (Schunk

& Pajares, 2002). Consistent with the theory, educational researches indicate that students with high academic self-efficacy demonstrate more effort (Schunk, 1983). higher persistence (Bandura & Schunk, 1981; Schunk, 1982), and higher levels of performance (Multon, Brown, & Lent, 1991).

From where do students get their perceptions of competence? Bandura (1986) identifies four principal sources in developing a strong sense of self-efficacy: mastery experience, vicarious experience, verbal persuasion, and physical and emotional states. However, it is not the type of source but how an individual evaluates information that determines the strength of influence in developing self-efficacy. Bandura (1997) found that mastery experience is the most influential source while the other three sources are less powerful. Mastery experience is the interpretation of previous performance and created by robust success from past experience. Overcoming obstacles is required to develop a strong sense of efficacy. It is easy for a person to become discouraged by failure when they have only had easy successes. The ability to make failure informative instead of moralising builds a resilient sense of efficacy. Thus, instead of becoming discouraged, people can learn from mistakes. Furthermore, mastery experience significantly predicted science self-efficacy of middle school pupils (Bandura, 1997). Britner and Pajares's (2006) study support Bandura's (1997) self-efficacy tenet that mastery experience was the only significant source in predicting science self-efficacy in the middle school students, and contributed the largest share of the variance (24% for the total sample, 35% for girls, 17% for boys). The other three sources contributed only minor percentages. In other words, past mastery experiences have strongest influence upon perceptions of competence (Bandura, 1997; Stipek, 2002). Pupils may decide they are capable of solving advanced science problems if they have

already performed well on science tests. Their perceptions of competence may also be influenced by their social comparisons with peers (Rosenholtz & Simpson, 1984). If they get higher scores than classmates on science investigations, they may perceive that they have the competence to apply scientific methods successfully.

Research has found significant correlations between self-efficacy and academic achievement, and self-efficacy has been identified as a strong predictor of academic achievement (Bandura, 1986; 1997). A number of studies have yielded similar findings. Pajares, Britner and Valiante (2000) found that self-efficacy was strongly and positively associated with science achievement ($r = 0.60$, $p < 0.0001$) in the middle school students. Bouffard-Bouchard, Parent, and Larivee (1991) found that the high self-efficacy groups of junior and high school students performed significantly better and persisted longer than the low self-efficacy groups in problem solving. Pajares and Kranzler (1995) found a strong direct effect of mathematics self-efficacy with path analysis on mathematics performance ($\beta = 0.349$) in high school students, and mathematics self-efficacy was positively and strongly associated with mathematics performance ($r = 0.64$, $p < 0.0001$). Schunk (1981) also used path analysis to determine a direct effect of self-efficacy on persistence and arithmetic achievement in elementary school students (between 9 and 11 years old). Relich, Debus and Walker (1986), and Schunk and Gunn (1986) used path analysis and found direct effects of self-efficacy on mathematics division achievement.

Furthermore, self-efficacy has been identified as a strong predictor of academic achievement across domains and year levels (Britner & Pajares, 2006). Research has shown the relationships between self-efficacy and academic performance in several academic domains, including science (Britner & Pajares, 2006), mathematics (Pajares & Kranzler, 1995) and English (Pajares & Valiante,

1999). Pajares & Valiante (1999) reported grade 6 students had higher writing self-efficacy than their older peers in grades 7 and 8. In addition, gender might show differences in different domains of self-efficacy. For example, while Britner and Pajares (2006) found that females in the middle schools exhibited higher science self-efficacy than males, Pajares and Kranzler (1995) and Pajares (1996) found no differences in mathematics self-efficacy in high school and middle school students, respectively. Thus, self-efficacy beliefs, as previously shown, can be specific for academic subject areas as Pajares (2006) suggests.

There are several issues the present study addresses in relation to self-efficacy. Firstly, research suggests that learning practice within schools influence the sense of self-efficacy students have for their studies. This study includes three types of schools. It is hypothesised that these different types of schools theoretically contribute to different strength of self-efficacy beliefs, particularly in the Science domain of this study. By using type of school as an independent variable, it will be possible to examine if self-efficacy can predict achievement. Secondly, by using self-efficacy as predictor variables, it will be possible to regress these variables against the independent variable of school achievement to analyse how much of the variance in Science achievement is predicted by self-efficacy. Thirdly, whilst this study is not cross-cultural, much of the evidence of the relationship between self-efficacy and achievement has been in the U.S. context. Although it was suggested that the Hong Kong context is different in the U.S. context, there is in logical reasons to suspect that the relationship between self-efficacy and achievement will have no differences in the Hong Kong context. Lastly, previous research has found gender and year level differences in self-efficacy beliefs in middle school students in the United States. This study examines if there is any year level and gender differences

in junior secondary students. Therefore, understanding self-efficacy beliefs of junior secondary school students in different school types, year levels and genders within the Science domain specifically becomes interesting issues, and whether the self-efficacy beliefs can predict Science achievement in the Hong Kong context.

Achievement Goal Orientations

Achievement goal theory focuses on the reasons that students engage in academic tasks by answering a fundamental question, "Why am I doing this [academic] task?" (Pintrich & Schrauben, 1992). While some goals are related to specific targets or end results the students are trying to achieve (e.g. getting an 'A' in a physics course), goal orientations are aimed at identifying the underlying reasons why students undertake a specific course of action in the first place (Urdan, 1997). Furthermore, the purpose of an achievement goal relates to achievement behaviour (Ames, 1992), which is defined by Nicholls (1984) as "behaviour directed at developing or demonstrating high rather than low ability" (p. 328).

Researchers have identified several goal orientations which share a common theme with different terms and interpretations. Dweck's (1986) theory describes students as having learning and performance goals. A learning goal concerns the desire for mastery in developing new skills and understanding, and increasing competence when undertaking an academic task (Dweck & Leggett, 1988). Dweck and her colleagues labelled this construct as "learning", Ames (1992) used the term 'mastery", and Nicholls and his colleagues (e.g., Duda & Nicholls, 1992; Nicholls, 1984; Nicholls, 1989; Nicholls, *et al.*, 1990) preferred "task". Thus, a learning goal is also referred to as a "task" or "mastery" goal (e.g., Ames, 1992; Nicholls, *et al.*, 1990). A performance goal focuses on ability (Elliott & Dweck, 1988) and

demonstrating superior ability (Nicholls, *et al.*, 1990). Hence, a performance goal is also labelled as "ego" by Nicholls and his colleagues (e.g., Duda & Nicholls, 1992: Nicholls, 1984; Nicholls, 1989; Nicholls, *et al.*, 1990). The framework of achievement goal orientations in this study consists of Dweck's (1986) two goal approaches: learning (task or mastery) and performance (ego) goals.

Students with a learning goal are interested in increasing competence (Dweck, 1986) and in mastering new tasks (Ames, 1990). They may be seen as posing the question, "How can I best acquire this skill or master this task?" (Elliott & Dweck, 1988, p. 5-6). Their attention is on finding strategies for learning (Dweck, 1999). They tend to believe that success or failure is caused by effort, and are aware of the importance of effort (Butler, 1987). They view mistakes as part of the learning process necessary for improvement (Ames, 1990), perceive difficult tasks as a challenge (Dweck & Leggett, 1988), and believe that intelligence is malleable and can be enhanced by effort (Dweck, 1986). They may feel pleased when they succeed on a task or solve a problem (Nicholls, *et al.*, 1990). They are concerned with success achievement rather than failure avoidance, and in the face of academic difficulty or failure, are likely to demonstrate high persistence (Bandura & Schunk, 1981; Elliott & Dweck, 1988). Their focus is not on the judgments of their current ability but the right strategies in learning. They concentrate on their personal learning, understanding and task mastery rather than seeking to appear to be better than others.

In contrast, students with a performance goal are concerned about winning favourable judgments and avoiding negative judgments of their competence (Dweck & Elliott, 1983; Elliott & Dweck, 1988; Nicholls, 1984). They focus on measuring their ability on the basis of their performance, and may focus upon the question, "Is

my ability adequate?" (Elliott & Dweck, 1988, p. 5). When they confront failure. they may view the outcome as evidence in answering that question, and as a result, attribute poor performance to low ability (Elliott & Dweck, 1988). In contrast, when they perform well, they tend to attribute success to their high ability (Duda & Nicholls, 1992). They try to ensure success by hiding their inabilities in choosing easy tasks to avoid making mistakes and to protect self-worth (Covington, 1992). In other words, regard intelligence as a fixed trait (Dweck, 1986), they want to "look smart" and "avoid looking dumb" (Dweck, 1999, p. 15). Performance oriented students compare their own performance to others and seek to demonstrate their abilities as superior, feeling successful when they perform better than their peers (Nicholls, *et al*., 1990). For example, they feel pleased when they are the only students who can answer a question. They are looking for praise, good grades or rewards (Butler, 1987). Nevertheless, in the studies of Elliott & Dweck (1988), students with high perceived ability and performance goals responded to obstacles in mastery pattern, persisted in attempts to look for solutions, and did not show negative affect or make attribution for their mistakes; nevertheless, they avoided picking the tasks that involved showing errors in public.

A summary of six different aspects of learning and performance goals is presented in Table 2.2. These two achievement goals are suggested to be critical determinants of mastery oriented and learned helplessness oriented achievement behavioural patterns (Dweck & Elliott, 1983; Elliott & Dweck, 1988; Nicholls, 1984). Table 2.3 shows the summary of goals and predicted achievement patterns. In short, learning and performance goals are critical determinants of achievement behavioural patterns. Achievement goal orientations show students' reasons to work and their approaches to tasks and engagement in activity, in turn. influence academic

outcomes, such as higher school marks or grades. In addition, research reveals that the practices of schools have important impact on students (e.g., Maehr, 1991; Roeser, Eccles, & Sameroff, 2000), and goal orientations are strongly related to the practices of schools (Anderman & Maehr, 1994; Anderman, Maher & Midgley, 1999; Maehr, 1991). Studies of Maehr & Midgley (1996) indicate that when school practices put emphasis on effort and self-comparison, task orientation may turn out to be more significant; in contrast, when the school practices in encouraging social comparison to make ability differences more prominent, performance orientation might become more salient.

This original mastery-performance goal dichotomy has been proposed to be revised by Elliot and his colleagues to include the distinction between approach and avoidance goals to form mastery-approach and mastery-avoidance goals (Elliot & McGregor, 2001), and performance-approach and performance-avoidance goals (Elliot & Church, 1997; Elliot & Harackiewicz, 1996). Elliot and his colleagues have proposed a new achievement orientation construct, mastery-avoidance goals. Elliot and McGregor (2001) postulate mastery-avoidance goals with self-regulation according to evaluative reference to specific task and concentration on avoidance of negative possibility. Several examples are as follows: students avoid misunderstanding course materials or failing an examination, and perfectionists strive to avoid making mistakes or doing anything incorrectly (Flett *et al.*, 1998). Although results in the studies of Elliot and McGregor (2001) supported the possibility of the mastery-avoidance goal construct, mastery-avoidance goals did not show significant intercorrelations with SAT achievement scores. In contrast, performance-approach goals were positively and significantly correlated to SAT achievement.

Furthermore, Elliot & Harackiewicz (1996) characterise another new goal orientation construct, performance-avoidance goals, with self-regulation regarding to potential negative outcomes, and this form of regulation is posited to evoke self-protective processes (e.g., threat rationalisation, sensitivity to failure-related information, task and anxiety distraction) that generate the helpless pattern of motivational outcomes. In the empirical work of Pajares, Britner and Valiante (2000), the results revealed significant correlation between performance-approach goals and GPA scores; nevertheless, performance-avoidance goals did not show any significant relationship with GPA performance of middle school students. More interestingly, despite three decades of theoretical and empirical work conducted in the achievement motivation literature involving mastery-performance goal dichotomy, Brophy (2005) argues that performance goals are rarely displayed in students, and goal theorists should withdraw from performance goals. Brophy (2005) explains that when elementary and middle school students were asked to elicit their perceptions relating to the purposes of achievement, learning and motivation in the studies of Urdan and his colleagues (Urdan, 2001; Urdan, Kneisel, & Mason, 1999), the students rarely mentioned the characteristics of performance goals spontaneously to demonstrate their competence relative to others. It is, therefore, an open question whether performance goals will be significantly related to achievement.

Clearly, there are many issues regarding the new direction of achievement goal theory. In considering the evidence in relating to achievement, this study will examine the classical mastery-performance goal dichotomy. There are several issues the current research addresses in relation to achievement goal orientation. Firstly, much of the research showing the relationship between achievement goal orientation

and performance has been conducted in the West. It was suggested that the Hong Kong context is different; and therefore, there is insufficient evidence to support the claim that the relationship between achievement motivation and performance will not show any differences in the Hong Kong context. This study would like to address this issue and find out whether achievement goal theory that is modelled in the West can be applied to the Chinese students in Hong Kong. Secondly, research suggests that learning practice within schools influence the type of orientations students have for their studies. In this study, there are three types of schools. It is hypothesised that these different types of schools theoretically create different achievement orientations. By using type of school as an independent variable, it will be possible to examine if achievement goal orientation can predict achievement. Understanding goal orientations of junior secondary school students in different school types becomes an interesting issue. Lastly, by using achievement goal orientations as predictor variables, it will be possible to regress these variables against the independent variable of school achievement to analyse how much of the variances in school achievement is predicted by achievement motivation, and whether the achievement goal orientation can predict Science achievement in the Hong Kong context.

Table 2.2. *Summary of learning and performance goals*

Characteristics	Learning	Performance
Success defined as:	Improvement, progress, mastery	High grades, high performance compared to others, winning, recognition, looking smart and not looking dumb
Value placed on:	Efforts	Succeeding with low effort
Reason for effort:	Personal meaning of activity, learning, mastery	Demonstrating ability
Evaluation criteria:	Absolute criteria (standard), evidence of progress	Comparison of their performance with another's
Errors viewed as:	Part of learning process, informational, a non-effective learning strategy	Failure, evidence of lack of ability or worth
Competence viewed as:	Increasing through effort	Inherited, fixed
Challenge:	Seeks challenge, attempts difficult tasks	Avoids risk taking, challenge and failure
Persistence:	High persistence in difficult tasks	Low persistence in face of difficulty

Note. From C. Ames and Archer (1988), Dweck and Leggett (1988), and Stipek (2002, p. 162).

Table 2.3. *Summary of learning and performance goals in predicting achievement patterns*

Goal value	Confidence (Perceived level of ability)	Predicted achievement pattern	
		Task choice	Response to difficulty
Performance goal is highlighted	High	Sacrifice learning and choose moderate or moderately difficult task to display competence	Mastery-orientation of effective problem-solving
	Low	Sacrifice learning and choose moderately easy task to avoid display of incompetence	Learned-helpless response of deterioration in problem-solving and negative affect
Learning goal is highlighted	High or Low	Choose learning at risk of displaying mistakes to increase competence	Mastery-orientation of effective problem-solving

Source: Elliott & Dweck (1988, p. 6)

Learned Helplessness Theory

In the original (Seligman, 1975) and reformulated theory of learned helplessness (Abramson, Seligman, & Teasdale, 1978), cognitive processes are at the centre of theory. The expectancy that no action will affect outcomes in the future is a sufficient cause to develop learned helplessness (Peterson & Seligman, 1984). The term 'learned helplessness' was first mentioned by Overmeir and Seligman (1967) to describe the situation when dogs exposed to uncontrollable laboratory electric shocks produced a cognitive deficit (perception of uncontrollability of negative events). The dog learned that it was not able to have control over the inescapable shocks by any of its voluntary responses. Uncontrollability, the perception of lack of control, is the critical determinant in the learned helplessness theory. The reformulated model of learned helplessness (Abramson *et al.*, 1978) is presented in Figure 2.1, which illustrates a simplified sequence of events for the developmental process of learned helplessness (Au, 2000, p.18). According to this reformulation, people seek explanations when they face negative life events that are perceived as lack of control. The way they explain the negative events may start the process of developing learned helplessness and influence how they respond to the events. Thus, the process of learned helplessness begins with explanatory style (Peterson & Seligman, 1984). People have their personal choices of explanatory style in the globality, stability and internality of causal beliefs when confronted with uncontrollable events. Causal explanations influence different expectations, which consecutively determine helplessness (Peterson, Maier, & Seligman, 1993). Abramson *et al.* (1978) postulates three different conditions of helplessness symptoms depending on the type of explanations: (a) If the cause of the negative event is explained by global factors (i.e., the cause may affect a wide range of outcomes), the expectation is apt to be

uncontrollable, which in turn leads to a wide range of helplessness symptoms, including motivational deficits (passivity), emotional deficits (sadness. anxiety, hostility), and cognitive deficits (perceptions of uncontrollability of negative events), (b) explanations consisting stable causes are apt to make expectation that the negative event tends to happen for a long time into the future, which leads to long-term helplessness symptoms, and (c) if the explanation for the negative event is internal (i.e., the cause may be something regarding the person, not about situation), then might lead to the symptom of lowered self-esteem. The expectations only need to be perceived as uncontrollable are sufficient causes to develop the helplessness deficits with the exception of lowered self-esteem, and the negative events do not need to repeat for a person to develop helplessness (Peterson & Seligman, 1984).

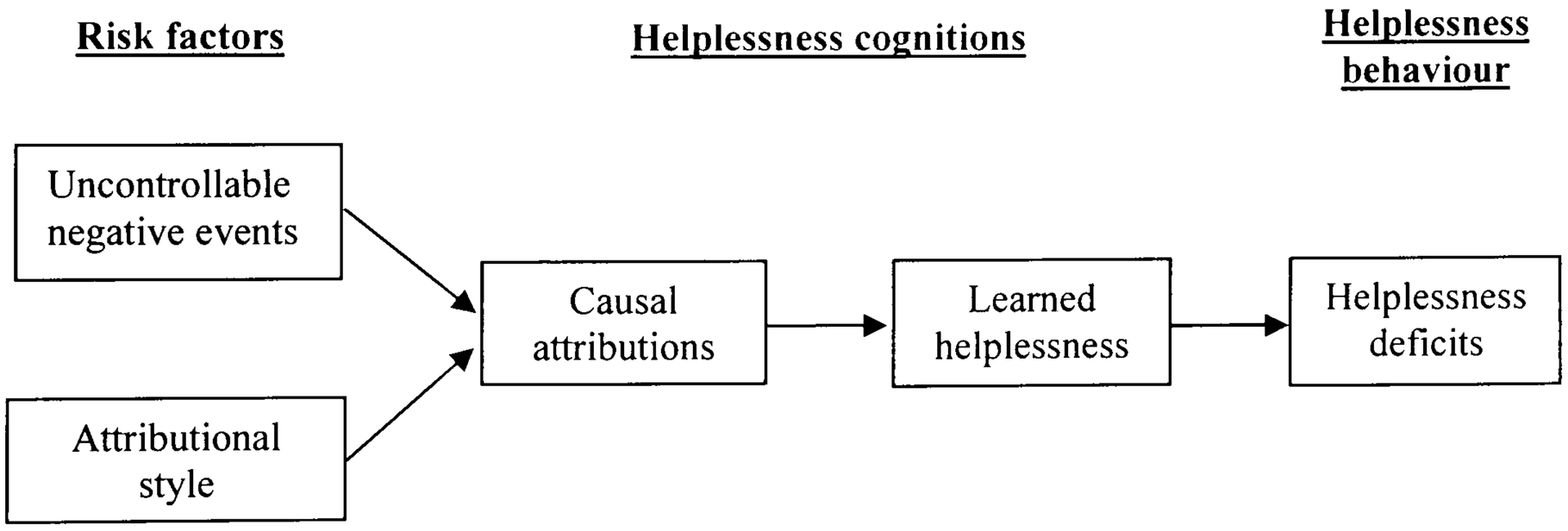

Figure 2.1. The reformulated model of learned helplessness (Abramson *et al.*, 1978). Source: Au, 2000, p. 18

From the academic perspective of the learned helplessness theory, Craske (1988) suggests that students with learned helplessness perceive that they are not able to control their own learning outcomes. They are not certain about their own ability nor believe themselves to be capable of having success. They often avoid challenges or new tasks (Diener & Dweck, 1978) and give up trying after failure because they perceive this to be the inevitable outcome, whether they apply effort or

not. As a result, they will feel that they lack control over outcomes and this will lead to deterioration of their academic performance. The student performance then will consistently worsen after failure on tasks of equal difficulty (Dweck & Reppucci, 1973; Diener & Dweck, 1978). The learned helplessness group sees themselves as not being useful in controlling outcomes, and are less likely to consider that they can overcome adverse circumstances because they have tendency to attribute failure to lack of ability rather than to lack of effort (Peterson, Maier, & Seligman, 1993). In Seligman's (1975) helplessness model, a perception of lack of control is the major determinant feature of learned helplessness. The condition of learned helplessness is predisposed to develop when students face academic failure and perceive they lack of control about the failure. They may give up trying because they do not perceive themselves as having the ability to succeed. In a study by Dweck (1975), students with extreme helplessness reactions to failure in arithmetic and severely deteriorated performance were treated with long-term attribution training. They were trained to take responsibility for their failure and to attribute their failure to lack of effort, instead of lack of ability. The programme provided attributional training to see whether the training would help lessen their helplessness condition and improve their performance. After the training, those students demonstrated great changes in their attribution of failure. They recognised effort as a determinant of failure and increased their persistence in efforts. Dweck and her colleagues (e.g., Diener & Dweck, 1978; Dweck & Ruppucci, 1973) suggest that repeated failure might disrupt academic performance, which leads to lower persistence and achievement levels. Research has indicated strong correlational relations between learned helplessness and achievement. In a recent study, Valaês (2001) investigated a sample of 1.575 students from grades 4, 7 and 9, and found that academic achievement was directly

and indirectly related to helplessness. A strong significant and negative correlation ($r = -0.59$) was found between achievement and helplessness.

This current research addresses several issues related to learned helplessness. This study examines the correlations between learned helplessness and achievement in different age and year level of junior secondary students. First, it is hypothesised that the older junior secondary students are predicted to demonstrate stronger learned helplessness. Second, by using year level as an independent variable. it will be possible to examine if learned helplessness can predict achievement. By using learned helplessness as a predictor variable, it will be possible to regress this variable against the dependent variable of school achievement to analyse how much of the variance in school achievement is predicted by learned helplessness. Third, although research suggests when students in the U.S. face academic failure and perceive they lack control about the failure are predisposed to develop learned helplessness, it is not logical to assume that the Chinese students in Hong Kong will show no differences. Therefore, understanding learned helplessness of junior secondary students in different year levels becomes an interesting issue, and whether their degrees of learned helplessness can predict Science achievement in the Hong Kong context.

Attitude towards Science

The definition of attitude towards science is a problematic issue raised by different researchers (e.g., Francis & Greer, 1999; Germann, 1988; Osborne, Simon, & Collins, 2003) because there are many concepts which may relate to the definition of attitude; for example, motivation, enjoyment, affect, interest, feeling, knowledge, and so forth. Generally, attitude includes three components: cognition, affect, and behaviour (e.g., Bagozzi & Burnkrant, 1979; Krech *et al.*, 1962). Reid (2006, p. 4) clearly describes the definitions of these components: (a) cognitive: "a knowledge about the object, the beliefs, ideas component"; (b) affective: "a feeling about the object, like or dislike component"; and (c) behavioural: "a tendency-towards-action, the objective component". In fact, these three components are closely linked together. For instance, when we have knowledge about science, and thus, have opinions or feelings about science, they may lead us to take actions. When three components are put together, attitude becomes a multifaceted multidimensional construct that is affected by numerous variables. On the other hand, other researchers suggest that these three components of attitude should be viewed independently (Fishbein & Ajzen, 1975). Various researchers (e.g., George, 2000; Germann, 1988) have defined attitude solely from the affective element. In other words, attitudes are therefore the beliefs that an individual holds, which is a unidimensional concept (Fishbein, 1967). It is the definition of attitude applied in this study. Fishbein (1967) has two strong arguments that favour a unidimensional attitude construct: (1) attitude determines beliefs and behavioural intentions; and (2) it is more productive to attitude studies if attitude is treated as affect and the other two components are viewed as related factors to attitude. Therefore, this study uses a

unidimensional attitude towards science construct to measure students' attitudes on their enjoyment and interest in science without complex interpretation.

Studies have found that attitudes affect students' performance (Papanastasiou & Papanastasiou, 2002; Papanastasiou & Zembylas, 2002). It is essential to examine the relationship between student attitudes towards science and their achievement in science. This study includes the construct of attitude towards science because researchers (e.g., Cannon & Simpson, 1985; Simpson & Troost, 1982) have suggested that student attitude towards science may determine their science achievement. Most studies investigating the relationship between attitudes towards science and science achievement have found positive correlations although these were mostly low or moderate (e.g., Germann, 1988; Young, Reynolds, & Walberg, 1996). Furthermore, a series of international comparative research has been conducted by the International Association for the Evaluation of Educational Achievement (IEA). The Third International Mathematics and Science Study (TIMSS) is one of the IEA's largest studies which has involved over 40 countries around the world to test elementary and middle school students within two subject areas, science and mathematics. A consistent relationship between achievement and attitude has been found in the TIMSS study (Beaton *et al.,* 1996). Students who perform better in school generally have more positive attitudes than those who do not do well in school (Beaton *et al.,* 1996). Studies conducted by Osborne and Collins (2000) and by Simpson and Oliver (1990) found similar results. Weinburgh (1995) conducted a meta-analysis covering 18 studies between 1970 and 1991, and also found a moderately positive correlation between attitudes towards science and science achievement. Willson (1983) performed an extensive meta-analysis that covered 43 literature, representing 638,333 students from 21 countries (e.g.,

Australia, Canada, Great Britain, Israel, USA), and from grades 3 to 12 (except 8) and college years. He found a moderate mean correlation ($r = 0.16$) ranging from -0.3 to 0.84 between attitudes towards science and science achievement, with around 86% of the correlation coefficients being positive. Willson (1983) and Steinkamp and Maehr (1983) conducted meta-analyses to examine the correlations between attitude towards science and science attainment, and both reported positive moderate correlations. Willson (1983) found a small correlation of 0.14, and Steinkamp and Maehr (1983) reported moderate correlations of 0.18 for girls and 0.19 for boys. They indicate that as attitudes towards science become more positive, students tend to have better science achievement.

This present study addresses several issues related to attitudes towards science. Although research has suggested that student attitude towards science may determine their science achievement in different countries, there is no sufficient evidence to support the claim that the relationship between attitude towards Science and Science achievement will be the same for Chinese students in the Hong Kong context. Moreover, based on the previous literature, females generally show lower science achievement than males. It is hypothesised that the female junior students will experience lower Science achievement and display more learned helplessness than the males. In particular, the older females with poorer Science achievement will be examined if they will demonstrate more learned helplessness than the younger students. Thus, understanding the relationship between attitude towards science and Science achievement becomes an interesting issue, particularly whether attitudes towards science can predict Science achievement in the Hong Kong context, particularly in the female junior secondary Chinese students.

Conclusion

In Hong Kong, students are influenced by Chinese cultural values that emphasise persistence and high effort, together with a harsh public examination system (Tang & Biggs, 1996), which may eventually lead to a decline in motivation. Hence, it is important to understand how academic achievement contributes to different motivational constructs in academic endeavours in the Hong Kong Chinese context. This study attempts to examine the pattern of motivation and achievement by investigating the relationships between Science achievement and motivational characteristics of junior secondary Chinese students with self-efficacy, achievement goal orientations and learned helplessness. Other construct including attitude towards Science is also examined in this study.

CHAPTER THREE

METHODOLOGY

Conceptual Framework of this Study

Motivation has a multifaceted nature, which cannot be explained with one comprehensive model. To examine the relationship between motivation and science achievement in Hong Kong Chinese junior secondary students, this study incorporates several theoretical constructs on motivation that are related to academic achievement. Variables included in this study are self-efficacy beliefs, achievement goal orientations, learned helplessness and attitude towards science. These motivational dimensions were selected on the basis of Bandura's (1997) academic self-efficacy beliefs, Elliott and Dweck's (1988) framework on achievement goal orientations, Abramson's *et al.* (1978) learned helplessness model, and Germann's (1988) construct of attitude towards science.

Galloway *et al.* (1996; 1998) argues that students' motivation can be varied in specific school subjects. These studies found a higher prevalence of learned helplessness and lower mastery orientation in English than mathematics. Marsh (1990) provides empirical evidence of subject specificity in students' self-perceptions of ability. However, little attention has focused on motivational responses in relation to specific school subjects other than English and mathematics, particularly in general science. Science is an important core subject in junior secondary public schools and international schools in Hong Kong. However, after Form 3, students in the public schools may choose to take the subjects according to their preferences for study. If their motivation in science has dropped in junior secondary schools, the number of students going into the science subjects in Form 4

or higher year levels might collapse. It will not only affect the structure of science education, but also weaken the development of science and technology industries in Hong Kong because the workforce in science might not be sufficient. Thus, the specific academic subject of 'Science' is selected for this study.

Four key characteristics of the participants' backgrounds, including their year level, age, type of school and gender, are examined to investigate how they relate to students' motivation pattern in this study. Indicators of motivation, such as changes in beliefs, attitudes and performance, have been specifically investigated by substantial literature. Many studies have provided evidence that there are declines in motivation in junior secondary schools (e.g., Anderman & Maehr, 1994; Eccles & Midgley, 1989; Simpson & Oliver, 1985). Eccles (1993) found a decline of academic motivation in junior secondary school students. A longitudinal and multidimensional study by Simpson and Oliver (1985) reported that students' achievement motivation dropped steadily from grades 6 to 8 with a significant sharp decline from the beginning to the middle of the year within each year level in middle school. In addition, they also found a sharp decline in attitude towards science from grades 7 to 8. Similar declines occur in self-efficacy (Shell, Colvin, & Bruning, 1995). Students possess a perception of increasing difficulty of academic subjects with age (Eccles *et al.*, 1983). Students' achievement orientation becomes more negative as their age increases (Eccles *et al.*, 1984). Based on the previous literature findings, year level-related and age-related changes in achievement beliefs and attitudes of the junior secondary students are also examined in this study.

Schools have a substantial impact on student development (Eccles, 2004; Eccles & Wigfield, 2002). Schools may cultivate their cultures from variations in school leadership, social class, ethnicity, parenting skill, peers, early childhood

experience and extra-curriculum activities (Maehr & Fyans, 1989). Other contributing factors include teaching and grading practices in schools; and the schools that emphasise grade standings relative to others might foster an ego-oriented school (Nicholls, 1989). School culture may influence students' motivation and achievement patterns (Baden & Maehr, 1986). Students' backgrounds often determine the type of school they go to. Students from wealthier families and ethnics other than Chinese usually go to international schools while the students from middle-class and lower-class families mostly go to government-aided public schools or direct subsidy scheme schools in Hong Kong (See sampling method in chapter three and Appendix II for details of the comparisons in those three types of schools). Because school cultures may influence students' motivation and achievement, there may be differential patterns of motivation and achievement between different types of schools, including international schools and public schools, in Hong Kong.

Sampling from different types of schools may increase the generalisation of participants. The diversity of student backgrounds from different types of schools adds to the validity of a study. However, most studies generally include only one type of school. Little attention has been put on the comparisons of students' motivational responses from different types of schools. Thus, this study includes type of school as a variable.

In general, research in science education suggests that gender may influence attitudes towards science, and gender differences are present in students' attitudes towards science and science achievement. Males usually show more interest in science than females (Kahle, 1990). There is substantial evidence that males exhibit a more positive attitude towards science and have higher motivation to achieve in science. For example, studies by Gallager (1987) showed that males have a more

positive attitude towards science than females. Simpson and Oliver (1990) conducted a longitudinal study, representing approximately 4,000 students from Grades 6 through 10, to investigate the relationship of attitudes towards science and science achievement over each of the school years and across the year levels by gender. They also reported that boys exhibited more positive attitudes towards science than girls. Schibeci and Riley (1986) conducted an investigation on the influence of students' background characteristics and perceptions on attitudes and achievement in science by using a sample data from 1976 to 1977 National Assessment of Educational Performance (NAEP). They suggested that gender significantly influences perceptions on science attitudes which, in turn, affect achievement; and males showed more positive attitudes and higher attainment than females. Again, the analysis showed that males exhibited more positive attitude towards science than females, and moderately positive correlations between attitude towards science and science achievement for both genders. Following the same logic, there should be moderate gender differences in other science related motivational constructs and science attainment. However, only few researchers have investigated these areas of gender differences; hence, gender difference is included as a variable in this study.

By understanding the relationships between motivation and science attainment of junior secondary Chinese students, science educators can foster appropriate student learning contexts and develop teaching methodologies in Hong Kong to raise student motivation and achievement in science. The following sections of this chapter presents the study method, research design, research question, sampling method, procedure of data collection, construction of the instrument, variable definitions, strategies of data analysis, and ethical issues of this study.

Research Question and Hypothesis

This study addresses the following four research questions and six hypotheses.

Research Question (1): There is strong evidence indicating a decline in motivation over the transfer from primary to secondary schools. Will there be lower motivation among higher year levels of Chinese junior secondary students in the Hong Kong context? If there is lower motivation, how do junior secondary students from different types of schools demonstrate different patterns in science motivation?

Research Hypothesis (1): Form 3 students will have lower motivation than Form 1 students in junior secondary schools in the Hong Kong context.

Research Question (2): What are the relationships between age and motivation in junior secondary students? Do older junior secondary students exhibit stronger learned helplessness, lower positive motivation (learning goal and self-efficacy), and less positive attitude towards Science than younger junior secondary students?

Research Hypothesis (2): Relative to younger junior secondary students (Age 11 and 12), older junior secondary students (Age 14 and 15) are predicted to demonstrate stronger learned helplessness, lower positive motivation (learning goal and self-efficacy). and less positive attitude towards Science.

Research Question (3): What are the relationships between Science achievement and student characteristics (year level and type of school), and Science achievement and motivation? What is the major motivational factor contributing to Science achievement? In particular, poor Science achievement might be a predictor of learned helplessness, or vice versa. Higher Science achievement might predict higher degrees of positive motivation in Science, or vice versa.

Research Hypothesis (3): There will be a negative correlation between year level and Science achievement. The higher year level the junior secondary students, the lower their Science achievement will be.

Research Hypothesis (4): There will be a negative correlation between Science achievement and negative motivation, and a positive correlation between Science achievement and positive motivational influence. The poorer the junior secondary students' Science achievement, the higher the degrees of learned helplessness will be. On the other hand, the better the Science achievement, the higher the degrees of learning goal, self-efficacy and attitude towards Science.

Research Question (4): Based on Science achievement, will gender differences prevail in different year levels of junior secondary Chinese students? Will females display lower motivation than males in the junior secondary schools in Hong Kong?

Research Hypothesis (5): Males will outperform females in Science achievement.

Research Hypothesis (6): Females will demonstrate lower motivation in the Science domain than males in the junior secondary schools in Hong Kong.

Design of the Study

The main purpose of the current study was to examine the strength of associations between motivation and Science achievement of Hong Kong junior secondary Chinese students. Quantitative research methods are an appropriate approach for this study because the objective testing and analyses assign numerical meanings and use descriptive, correlational and inferential statistics to mathematically measure the degree of significant relationships and differences in motivation and Science achievement of the junior secondary students. Quantitative research is designed to test theories (Creswell, 1994) while qualitative research techniques are used to develop theories (Taylor, 2000). This study adopted various motivation theories, and then tested whether or not those theories could apply in the sample population of the junior secondary Chinese students in Hong Kong. Since this research is to test theories and not to develop theories, a quantitative research method is employed for the current study.

A self-report questionnaire was designed to elicit responses from students on their views towards Science. It included items in relation to various motivational concepts, perceptions, attitudes towards Science and demographic profile. All the motivational measures consisted of a six-point rating scale, ranging from strongly disagree to strongly agree. The scales and items were discussed with a group of Chinese doctoral researchers and Hong Kong educators (including a university

professor) and piloted with a small group of students at an international school on two occasions (once in fall 2004 and again in winter 2004). To reduce response bias, 9 negative worded items were constructed in addition to 20 positive items (Nunnally, 1978). Reverse-coding was performed on the negative items prior to any statistical analyses. The students' (gender, age and year level) and their parents' (parental education and occupation) background information was also collected when designing the demographic profile. The students were not allowed to write their name on the questionnaire to assure maintaining their anonymity. The questionnaire was translated into traditional Chinese and matched colloquial Cantonese by using the translation/back-translation method (see Appendix IV).

This study employed a cross-sectional research method to examine students' motivation towards Science. The sample consisted of Form 1 (n = 388), Form 2 (n = 285) and Form 3 (n = 327) students from seven schools to investigate if any differences in their motivational patterns from different year levels of junior secondary schools (N = 1,000). A comparative study was also employed in this research by drawing the sample from three different types of schools (government-aided, DSS and international schools) and year levels (Form 1, 2 and 3) to investigate the similarities and differences of the sample on Science achievement in relation to their motivational patterns and family backgrounds.

Sampling Method

In the 2004/05 academic year, the total number of secondary schools in Hong Kong was 519 (EDB, 2006a). These schools were made up of 496 local schools, 6 ESF and 17 private international schools. Government-aided schools are the most common financial type of local schools in Hong Kong and the trend has been to

convert to DSS schools in the current decade. There were 47 DSS schools in 2004 and there will be more government-aided schools converting to DSS schools in the future. These government-aided schools follow a similar grading system and instructional structure is set by the Education Bureau in Hong Kong. The average class size was 38.2 students (EDB, 2006a). The Hong Kong government supported all student education from Primary One up to Form Three. Students did not have to pay tuition until they finished junior secondary school. DSS schools had their own student admission policies and tuition fees were between US$1,300 and US$4,000 per year. The average class size was around 32 students. The international schools followed a similar grading system in a small class environment, averaging between 15 and 30 students per class. Most of the international schools in Hong Kong usually applied the same instructional method using the standard Key Stage 3 curriculum from the United Kingdom. The annual tuition fees for international schools were between US$8,400 and US$17,000. The details of the characteristics of government-aided schools, DSS schools and private independent schools are attached in Appendix II.

The majority of secondary schools in Hong Kong were government-aided schools (approximately 75%). After students completed Primary Six (Year 6), they were allocated to Form 1 (Year 7). In the Hong Kong educational system, local schools were divided into three bands, from Band One (highest achieving schools) to Band Three (lowest achieving schools), or DSS schools and international schools without banding. English and Chinese were the two major languages applied in the schools in Hong Kong for instruction. There was no banding for both DSS schools and international schools. Students attending DSS schools or international schools were usually the ones who could not cope with the current traditional local

curriculum, teaching methods, or they might prefer English as the medium of instruction. Their English skill levels have a wide range.

In this study, government-aided and DSS schools were selected for two reasons: First, government-aided school were the most common financial type of local schools in Hong Kong. Second, government-aided schools were following a new trend of converting to DSS financial type of schools. International schools were also very popular and a desirable type of school for the local school students in Hong Kong to transfer to. Thus, international schools were also included in this study. The sample schools were chosen according to their type, banding, and locations that included Hong Kong Island, Kowloon and the New Territories. In addition, this study focused on the Chinese students because approximately 95% of Hong Kong's population (6.9 million) was Chinese (C&SD, 2007).

In terms of sample size for the different groups, the initial plan was to include all three years of junior secondary school students, Form 1, Form 2 and Form 3, from three popular types of schools in Hong Kong. The planned distribution of the student sample from the three types of schools in this study is illustrated in Table 3.1. The planned total number of students for the entire sample was 1,050; 350 from each year level. Sixty students would be drawn from each year level of three government-aided schools and two DSS schools. Because the class size of international schools was much smaller than the local schools, the proposed number of students from international schools was proportionally smaller. Only twenty five students were drawn from each year level of two international schools. In considering three major factors including types of school, school bandings, and geographic locations, this study recruited one school from each of the three types of schools in the Kowloon area, while only one IS and one DSS schools were from Hong Kong Island and two

schools in the New Territories showed interest in participating in this study. The principals or leading teachers at the participating schools distributed the questionnaires to various class teachers. The class teachers gave out the questionnaires and collected the completed questionnaires.

Table 3.1. *The proposed distribution of student sample from three types of schools*

Type of school	Number of school	School label	Number of student			
			Form 1	Form 2	Form 3	Total
Government-aided school	3	School A	60	60	60	180
		School B	60	60	60	180
		School C	60	60	60	180
International school	2	School D	25	25	25	75
		School E	25	25	25	75
DSS school	2	School F	60	60	60	180
		School G	60	60	60	180
Total	7		350	350	350	1050

Procedure of Data Collection

Students completed the questionnaires in classroom settings. The questionnaires were administered by the class teacher in the seven participating schools between March and April 2005. The whole procedure lasted between 20 and 25 minutes in the regular class period. Standardised sets of instructions were read aloud to students after the questionnaire was presented to the students. The teachers answered any questions before students completed the questionnaires. To protect the identity of students, students were not allowed to write their names on the questionnaire. To ensure confidentiality, limited identification (only type of school,

year level, gender and Chinese status) was employed during the data analysis process. Envelopes contained the questionnaires were labelled with the students' year levels. The class teachers or principals identified type of school and non-Chinese students of the sample. Because this study was only interested in responses from the Chinese students, questionnaires collected from the non-Chinese students were discarded.

Instrumentation

A self-developed survey questionnaire for students was employed in this current study. To illustrate the students' motivation in different types of schools, this study integrated various motivational concepts in the composition of the student survey. The details of the instrument are as follows:

Construction of Student Questionnaire

This study employed a two-part 29-item questionnaire design (see Appendix III & IV). Each part of the questionnaire focused on different areas. The first section contained questions based on the conceptual framework of this study to measure students' perceptions of Science performance. The second section of the questionnaire contained questions regarding students' backgrounds, which included gender, age, parents' education level and occupation, type of housing, and school academic results in Science. Students answered the questions themselves on an easy-to-use form, and rated their perceptions on an even number 6-point Likert rating scale that would yield a sensitive range of numerical data responses requiring respondents to indicate a decision on rating (Cohen *et al.*, 2000). The data were analysed by using SPSS computer software. The coding system of the questionnaire is illustrated in the ***Variables*** section later in this chapter. Scales of the five

motivational dimensions were set on a rating between '1' and '6'. The relative strength of each extreme is reflected with a number between '1' and '6'. '1' means the student 'strongly disagree' with the statement and '6' represents the student 'strongly agree' with the statement.

The survey focused on measuring achievement motivation, including self-efficacy beliefs in mastering Science, achievement goal orientations, learned helplessness, and a concept related to motivation - attitude towards Science. Table 3.2 demonstrates the questions measuring the five motivational dimensions of students. In this survey, the scales for the achievement goal orientations and self-efficacy were adapted from the Patterns of Adaptive Learning Scales (PALS, Midgley *et al.*, 2000). The learning goal orientation scale (4 items) measured students' desire to learn new science concepts and to master challenges in Science. The performance goal orientation scale (4 items) measured students' desire to show off their higher ability than their classmates and to gain auspicious compliment from their teachers. Self-efficacy beliefs scale (10 items) measured students' efficacy beliefs in their ability to master science-related work, content and skills. Attitude towards Science construct items were based on the instrument of Attitude Toward Science in School Assessment (ATSSA, Germann, 1988). The attitude towards Science scale consisted of seven items to measure the level of students' enjoyment and interest of Science. The questionnaire included one negative motivation, learned helplessness. Four items in this survey were based on Seligman's (1975) learned helplessness theory to measure the level of students' perception of lack of control, not capable of having success, and giving up trying after failure.

Table 3.2. *The five dimensions in the questionnaire*

Motivational Dimension		Item Number	Item Statement
Self-efficacy Beliefs in mastering Science			
1	**Self-efficacy beliefs**	Q1_1	I know I can fully develop the skills being taught in Science this year.
		Q1_2	If I try, I can do even the most difficult work in Science.
		Q1_3	If I don't give up, I can do most of the work in Science.
		Q1_4	I can learn Science even if the work is hard.
		Q1_5	I know I can find out how to do difficult work in Science.
		Q1_6r	Whenever I take Science tests or examinations, I become very nervous.
		Q1_7r	It is very difficult for me to concentrate on Science work.
		Q1_8r	Many Science topics are too difficult for me to handle.
		Q1_9r	I feel like I don't want to learn Science any more because I have too many difficulties.
		Q1_10r	It is difficult for me to effectively organise my study time for Science.
Achievement Goal Orientation towards Science			
2	**Learning goal**	Q3_1	I try to do well on my Science work.
		Q3_2	I always try to do Science work better everyday.
		Q3_3	I enjoy answering difficult Science problems.
		Q3_4	I work hard to master difficult ideas in Science.
3	**Performance goal**	Q5_1	I want to get higher Science marks than my classmates.
		Q5_2	I want to show my classmates that I am clever.
		Q5_3	I try to bring honour to my parents by working hard in Science.
		Q5_4	I try to please my teachers by doing well on my Science work.

Negative Motivational Behaviour towards Science			
4	**Learned helplessness**	Q2_1	My past Science failures tell me that I will continue to fail again and again.
		Q2_2	There is not much I can do to improve my Science marks.
		Q2_3	I will fail in Science even if I try harder.
		Q2_4	I cannot do anything to improve my Science work.
Attitude towards Science			
5	**Attitude towards Science**	Q4_1	I feel good about my Science work.
		Q4_2	I enjoy my Science lessons.
		Q4_3	There are many interesting things in Science.
		Q4_4r	I don't feel happy about my Science work.
		Q4_5r	My Science lessons are boring.
		Q4_6r	I'm not interested in Science.
		Q4_7r	When I do badly on the Science test, it is because I am not interested in the topic.

Variables

In this study, a total of 9 variables related to students, family backgrounds, Science achievement, motivational measures and attitude towards Science in the survey questionnaires were analysed. Each variable was coded by dummy variables. All coding and direction was checked. The mean scores of the motivational measures were transformed and computed. The variables are as follows:

(1) **Age**: This variable was based on students' response of their month and year of their birthday. [1 = 11, 2 = 12, 3 = 13, 4 = 14, 5 = 15, 6 = 16 or older].

(2) **Type of school**: This variable was the type of school on nominal measure. [1 = government-aided, 2 = DSS, 3 = international].

(3) **Year Level**: This index was derived from students' schooling year level. [1 = Form 1, 2 = Form 2, 3 = Form 3].

(4) **Science achievement grade**: This variable was derived from students' responses to one item on a 6-point scale of letter grade they received for Science in the mid-term report card. Science, in this study, refers to an academic subject without any specific course or activity that happens inside or outside of school. The grading system in both private international schools was letter grades while the other two types of schools were using marks in the student report cards. The letter grade 'A' represents the marks above 90, 'B' between 80 and 89, 'C' between 70 and 79, 'D' between 60 to 69, 'E' between 50 to 59, and 'F' for non-pass. Both government-aided schools and DSS schools are giving marks without letter grades in their report cards, except at the Form 3 level of one DSS school. In this study, all the marks were converted into grades for statistical calculations. [1 = F, 2 = E, 3 = D, 4 =C, 5 = B, 6 = A].

All of the following variables from (5) to (9) applied the same coding data input on a 6-point scale. [1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = somewhat agree, 5 = agree, 6 = strongly agree].

(5) **Learning goal**: This index was derived from students' responses to four positive statements on personal goal orientation in mastering task: (Q3_1) I try to do well on my Science work; (Q3_2) I always try to do Science work better everyday; (Q3_3) I enjoy answering difficult Science problems; and (Q3_4) I work hard to master difficult ideas in Science.

(6) **Performance goal**: This index was based on students' responses to four positive items on performance goal in Science: (Q5_1) I want to get higher Science marks than my classmates; (Q5_2) I want to show my classmates that I am clever; (Q5_3) I try to bring honour to my parents by working hard in Science; and (Q5_4) I try to please my teachers by doing well on my Science work.

(7) **Learned helplessness**: This variable was derived from students' responses to four items on negative motivation of learned helplessness: (Q2_1) My past Science failures tell me that I will continue to fail again and again; (Q2_2) There is not much I can do to improve my Science marks; (Q2_3) I will fail in Science even if I try harder; and (Q2_4) I cannot do anything to improve my Science work.

(8) **Attitude towards Science**: This variable was based on students' responses to three positive and four negative statements about attitude towards Science: (Q4_1) I feel good about my Science work; (Q4_2) I enjoy my Science lessons; (Q4_3) There are many interesting things in Science; (Q4_4r) I don't feel happy about my Science work (reversed scale); (Q4_5r) My Science

lessons are boring (reversed scale); (Q4_6r) I'm not interested in Science (reversed scale); and (Q4_7r) When I do badly on the Science test, it is because I am not interested in the topic (reversed scale).

(9) **Self-efficacy beliefs:** This variable was based on students' responses to five negative and five positive statements about beliefs in Science ability: (Q1_1) I know I can fully develop the skills being taught in Science this year; (Q1_2) If I try, I can do even the most difficult work in Science; (Q1_3) If I don't give up, I can do most of the work in Science; (Q1_4) I can learn Science even if the work is hard; (Q1_5) I know I can find out how to do difficult work in Science; (Q1_6r) Whenever I take Science tests or examinations, I become very nervous (reversed scale); (Q1_7r) It is very difficult for me to concentrate on Science work (reversed scale); (Q1_8r) Many Science topics are too difficult for me to handle (reversed scale); (Q1_9r) I feel like I don't want to learn Science any more because I have too many difficulties (reversed scale); and (Q1_10r) It is difficult for me to effectively organise my study time for Science (reversed scale).

Strategies of Data Analysis

The responses from student questionnaires were mainly analysed by using SPSS for Windows. Supplementary graphs and simple calculations were presented using Microsoft Excel. To examine the relationships of motivation and Science achievement in junior secondary school students in Hong Kong, data were analysed in various fashions: univariate and bivariate descriptive analyses, explanatory analyses including correlation and regression, inferential analyses using independent *t* test and analysis of variance (ANOVA), internal consistency estimates of reliability

and effect size. All of the hypotheses in this study were tested at the $p < 0.05$ significant level (two-tailed).

Descriptive Statistics

Frequency tables, cross-tabulations, multiple response tables and line graphs were applied to illustrate the characteristics of student sample. participating schools and relationships between them.

Correlation and Regression Analyses

In the study, the Pearson`s Product Moment coefficients examined whether there were significant relationships between motivational dimensions and Science achievement. The predictive validity was assessed using simultaneous multiple regression analyses to analyse how well year level, type of school and motivational dimensions in predicting Science achievement. A series of simultaneous multiple regression was conducted to analyse how well Science achievement in predicating the motivational measures.

Internal Consistency Estimates of Reliability

The internal consistency estimates of reliability of the questionnaire was measured by computing the Cronbach's alpha coefficient. Cronbach's alpha coefficients were also given for each of the five motivational scales to assess the association of each item whether they fit into their groups. Item analyses were conducted to assess all 29 items of motivational measures in the questionnaire whether they formed a reliable scale. Items that did not fit into any of the groups

would be eliminated. Cronbach's alpha coefficient of 0.70 or higher is regarded as acceptable and sufficient (Aron & Aron, 1999; Nunnally, 1978).

Inferential Statistics

An independent-samples *t* test was conducted to evaluate the hypothesis that there were significant gender differences on motivational dimensions. Two two-way analyses of variance (ANOVA) examined whether or not there were gender differences by year level on Science achievement and type of school differences by year level on Science achievement in the junior secondary school students. If the results indicated any significant main effects and interaction between the variables, follow-up tests would be conducted to evaluate the differences. This study used the Tukey procedure for homogeneous variances and Games-Howell procedure for non-homogeneous variances as *post hoc* follow-up tests. Various one-way analyses of variance (ANOVA) were conducted as well to determine the relationships between year level on motivational dimensions, age on motivational dimensions, type of school on motivational dimensions, and Science achievement on motivational dimensions.

Effect Size

An effect size is a calculated difference in the units of standard deviation. Effect sizes reveal standardised indices of how much influence treatments have on the dependent variable. However, sample sizes have partial impacts on the tests of statistical significance. To increase the comprehension of the meaning of the significant difference an intervention makes, this study exploited effect sizes, which use standard deviations instead of standard errors. Therefore, this study minimised the effect of sample sizes on the tests of statistical significance.

Cohen (1988) suggested using the *d* and *r* family values to support research examples as small, medium and large effects. This study applied both families. The Glass'*d* family of effect size puts an emphasis on the magnitude of differences (Cohen, 1988). When *d* value is equal to or larger than 0.20, the magnitude of difference between extents of the independent variable with regard to the dependent variable is small, 0.50 medium and 0.80 large. Besides *d* family, this study also employed Pearson *r*, partial η^2 and adjusted R^2 from the *r* family. The *r* family of effect size focuses on the strength of the relationship between the dependent variable and independent variable rather than magnitude of difference. The correlation of Pearson *r* coefficients of 0.10 is interpreted as small, 0.30 as medium, and 0.50 as large effect sizes. The squared version of eta (η^2) is actually a partial η^2 (Green & Salkind, 2005), and is used in this study because η^2 illustrates the percentage of variance in the dependent variable (Leech, Barrett, & Morgan, 2005). The independent variable(s) can predict the percentage of variance in the dependent variable. When η^2 is equal to or larger than 0.01, the strength of relationship is small, 0.06 medium, and 0.14 large. The adjusted R^2 is employed when many independent variables take into account. In other words, there is not only just one independent factor but many independent factors are used to predict the dependent variable. When multiple correlation (*R*) is equal to or larger than 0.14, the strength of relationship is small, 0.36 medium, and 0.51 large.

Ethical Issues

The respondents in this study were not under any coercion to complete the questionnaire. Participation in the study was voluntary and once students started completing the questionnaire, they had the right to not answer any specific items on

the questionnaire and withdraw from the research at any stage. These protocols guaranteed that responses were confidential, non-maleficent, anonymous and non-traceable. An informed consent form (see Appendix V) and a verbal assurance of the confidentiality of their responses were given to participants before completing the questionnaire for two purposes: (1) to ensure the participants that the collecting data will only serve for the research purpose of the current study; and (2) to encourage the participants to respond honestly and not to worry about the confidentiality of the data. Standardised sets of instructions were read aloud to participants after the questionnaire was presented to them. The monitoring researcher or teacher answered any questions before participants filled in the questionnaires. Based on the suggestions from Cohen *et al*. (2000), the questions in the questionnaire of this research avoided using any items that might cause any irritating, offensive, biased, misleading, misguided, inconsiderate, impertinent, intrusive or abstruse reactions. The data reporting procedure and method adopted in this study diminished threats and maintained high levels of internal validity and reliability.

Summary

Chapter three presented the research design and sampling techniques. This chapter also outlined the construction of instrumentation, procedural details, variable definitions and ethical issues. In addition, the chapter addressed the data analysis procedures to minimise threats to internal reliability and validity of the research design.

CHAPTER FOUR

RESULTS (PART I)

Part I. Sample of Participating Schools and Students, and the Measurement of Questionnaire

Sample of Participating Schools and Students

Descriptive Statistics

Seven schools participated in this study, including three government-aided schools, two direct subsidy scheme (DSS) schools and two international schools in Hong Kong. These three types of schools were popular types of schools in Hong Kong. One of the government-aided schools in this study was a Band One, Chinese as medium of instruction (CMI) school in the New Territory (N.T.). The other two government-aided schools were Band Two CMI schools, in N.T. and Kowloon. There are no bandings for both DSS and international schools. One of the DSS schools used English as the medium of instruction (EMI) in Kowloon and the other one was a CMI school on Hong Kong Island. The Chinese students in those two DSS schools generally came from Band 2 and 3 local schools. The international schools in Hong Kong were mostly EMI schools. One of the international schools in this study was located on Hong Kong Island and the other one was in Kowloon. Both of the international schools were EMI schools operating England's Key Stage 3 Science curriculum. Students' English skill abilities varied.

The sample of this study included one thousand students of junior secondary school students, Form 1 (n = 388), Form 2 (n = 285) and Form 3 (n = 327) from three popular types of schools in Hong Kong. The participants' ages ranged from eleven to seventeen. The average ages of the international school students were one year

younger and smaller range of age than the students from the other two types of schools. The government-aided schools take some new Mainland China immigrants, who tend to be older compared to their same form of classmates because of their lower English skill abilities. The sample consisted of 497 boys and 503 girls. (The sample size of the boys was larger in the private international schools because the schools had more boys than girls.) Students from all different ability levels were included. The participants in this study were all Chinese ethnics. Table 4.1, 4.2, and 4.3 show the details of the participants at each type of schools.

Table 4.1. *Number of students from Form 1 to Form 3 by type of school*

School Year Attending * Type of School Crosstabulation

			Type of School			
			Government-aided School	International School	DSS School	Total
School Year Attending	Form 1	Count	179	61	148	388
		% within School Year Attending	46.1%	15.7%	38.1%	100.0%
		% of Total	17.9%	6.1%	14.8%	38.8%
	Form 2	Count	78	46	161	285
		% within School Year Attending	27.4%	16.1%	56.5%	100.0%
		% of Total	7.8%	4.6%	16.1%	28.5%
	Form 3	Count	148	44	135	327
		% within School Year Attending	45.3%	13.5%	41.3%	100.0%
		% of Total	14.8%	4.4%	13.5%	32.7%
Total		Count	405	151	444	1000
		% within School Year Attending	40.5%	15.1%	44.4%	100.0%
		% of Total	40.5%	15.1%	44.4%	100.0%

Table 4.2. *Number of students by gender and type of school*

Student's Gender * Type of School Crosstabulation

			Type of School			
			Government-aided School	International School	DSS School	Total
Student's Gender	Boys	Count	196	104	197	497
		% within Type of School	48.4%	68.9%	44.4%	49.7%
		% of Total	19.6%	10.4%	19.7%	49.7%
	Girls	Count	209	47	247	503
		% within Type of School	51.6%	31.1%	55.6%	50.3%
		% of Total	20.9%	4.7%	24.7%	50.3%
Total		Count	405	151	444	1000
		% within Type of School	100.0%	100.0%	100.0%	100.0%
		% of Total	40.5%	15.1%	44.4%	100.0%

Table 4.3. *The age distribution of the participants by type of school*

Age of Respondent * Type of School Crosstabulation

			Type of School			
			Government-aided School	International School	DSS School	Total
Age of Respondent	11	Count	0	20	0	20
		% within Age of Respondent	.0%	100.0%	.0%	100.0%
		% of Total	.0%	2.0%	.0%	2.0%
	12	Count	92	55	61	208
		% within Age of Respondent	44.2%	26.4%	29.3%	100.0%
		% of Total	9.2%	5.5%	6.1%	20.8%
	13	Count	97	35	135	267
		% within Age of Respondent	36.3%	13.1%	50.6%	100.0%
		% of Total	9.7%	3.5%	13.5%	26.7%
	14	Count	124	26	141	291
		% within Age of Respondent	42.6%	8.9%	48.5%	100.0%
		% of Total	12.4%	2.6%	14.1%	29.1%
	15	Count	72	15	85	172
		% within Age of Respondent	41.9%	8.7%	49.4%	100.0%
		% of Total	7.2%	1.5%	8.5%	17.2%
	16 or older	Count	20	0	22	42
		% within Age of Respondent	47.6%	.0%	52.4%	100.0%
		% of Total	2.0%	.0%	2.2%	4.2%
Total		Count	405	151	444	1000
		% within Age of Respondent	40.5%	15.1%	44.4%	100.0%
		% of Total	40.5%	15.1%	44.4%	100.0%

Family backgrounds of the participating students

Tables 4.4, 4.5, 4.6, 4.7 and 4.8 illustrate the family background of the participants. About a quarter of the students did not report their parents' education. Around one-fifth of the students did not report their parents' occupation. Over 65% of participants were either the only child in the family or had only one brother or sister.

In the government-aided schools:

The students from the government-aided schools are predominately from families of lower socioeconomic classes. Over half (54%) of the students live in public housing estates. The majority of their fathers' occupation was manual work (41%). About 60% of their mothers were a housewife. Most of their fathers (60%) and mothers (63%) had not obtained more than a high school degree, 9% of their fathers and 11% of their mothers had received two years or less of a vocational or college program, and only 6% of their fathers and 3% of their mothers obtained a college degree or higher. Their parents had the lowest education standard than the parents of the other two types of schools.

In the international schools:

The students from both international schools are predominately from families of middle or higher socioeconomic classes. The majority of the students (64%) lived in the privately owned housing. Three quarters of their fathers were self-employed or worked as professionals. The majority of their mothers (40%) were self-employed or professionals. Only a quarter of their mothers were housewives. Their parents had higher education levels than the other two types of school students' parents. Over 47% of their fathers and 39% of their mothers had obtained a college degree or higher, and 4% of their fathers and 17% of their mothers received two years or less

of a vocational or college program. Only 11% of their fathers and 19% of their mothers had not obtained more than a high school degree.

In the Direct Subsidy Scheme schools:

The students from both DSS schools were predominately from families of middle or lower socioeconomic classes. Similar to the students in the international schools, the majority of the students (58%) lived in the privately owned housing. Half of their fathers were self-employed or professionals. About 40% of their mothers were housewives. However, in comparison to the parents in the international schools, their parents' education was mostly at the secondary level. About 40% of their fathers and 46% of their mothers had not obtained more than a high school degree, 12% of their fathers and 14% of their mothers received two years or less of a vocational or college program, and 22% of their fathers and 16% of their mothers obtained a college degree or higher.

Table 4.8 shows the language or dialect students spoke at home. Not surprisingly, in view of the fact that the primary language/dialect spoken in Hong Kong was Cantonese, the majority of the Chinese participants (94.8%) reported the language they spoke at home most of the time was Cantonese. Only minority of them spoke Mandarin or Chinese Dialects (n = 31, 3.1%), English (n = 19, 1.9%) and others (n = 2, 0.2%).

Table 4.4. *Fathers of the participants' education level by type of school*

Father's Education * Type of School Crosstabulation

			Type of School			
			Government-aided School	International School	DSS School	Total
Father's Education	University	Count	25	72	97	194
		% within Type of School	6.2%	47.7%	21.8%	19.4%
		% of Total	2.5%	7.2%	9.7%	19.4%
	Higher Diploma	Count	35	21	52	108
		% within Type of School	8.6%	13.9%	11.7%	10.8%
		% of Total	3.5%	2.1%	5.2%	10.8%
	Secondary	Count	194	15	155	364
		% within Type of School	47.9%	9.9%	34.9%	36.4%
		% of Total	19.4%	1.5%	15.5%	36.4%
	Primary	Count	50	2	23	75
		% within Type of School	12.3%	1.3%	5.2%	7.5%
		% of Total	5.0%	.2%	2.3%	7.5%
	Unknown	Count	101	41	117	259
		% within Type of School	24.9%	27.2%	26.4%	25.9%
		% of Total	10.1%	4.1%	11.7%	25.9%
Total		Count	405	151	444	1000
		% within Type of School	100.0%	100.0%	100.0%	100.0%
		% of Total	40.5%	15.1%	44.4%	100.0%

Table 4.5. *Fathers of the participants' occupation by type of school*

Father's Occupation * Type of School Crosstabulation

			Type of School			
			Government-aided School	International School	DSS School	Total
Father's Occupation	Self-employed/Owner	Count	63	68	130	261
		% within Type of School	15.6%	45.0%	29.3%	26.1%
		% of Total	6.3%	6.8%	13.0%	26.1%
	Professional	Count	46	44	92	182
		% within Type of School	11.4%	29.1%	20.7%	18.2%
		% of Total	4.6%	4.4%	9.2%	18.2%
	Technical	Count	32	6	30	68
		% within Type of School	7.9%	4.0%	6.8%	6.8%
		% of Total	3.2%	.6%	3.0%	6.8%
	Clerical	Count	9	3	19	31
		% within Type of School	2.2%	2.0%	4.3%	3.1%
		% of Total	.9%	.3%	1.9%	3.1%
	Manual	Count	165	2	64	231
		% within Type of School	40.7%	1.3%	14.4%	23.1%
		% of Total	16.5%	.2%	6.4%	23.1%
	Housewife/Homemaker	Count	0	0	2	2
		% within Type of School	.0%	.0%	.5%	.2%
		% of Total	.0%	.0%	.2%	.2%
	Retired	Count	4	1	8	13
		% within Type of School	1.0%	.7%	1.8%	1.3%
		% of Total	.4%	.1%	.8%	1.3%
	Unemployed	Count	14	1	4	19
		% within Type of School	3.5%	.7%	.9%	1.9%
		% of Total	1.4%	.1%	.4%	1.9%
	Unknown	Count	72	26	95	193
		% within Type of School	17.8%	17.2%	21.4%	19.3%
		% of Total	7.2%	2.6%	9.5%	19.3%
Total		Count	405	151	444	1000
		% within Type of School	100.0%	100.0%	100.0%	100.0%
		% of Total	40.5%	15.1%	44.4%	100.0%

Table 4.6. *Mothers of the participants' education level by type of school*

Mother's Education * Type of School Crosstabulation

			Type of School			
			Government-aided School	International School	DSS School	Total
Mother's Education	University	Count	13	59	70	142
		% within Type of School	3.2%	39.1%	15.8%	14.2%
		% of Total	1.3%	5.9%	7.0%	14.2%
	Higher Diploma	Count	46	25	60	131
		% within Type of School	11.4%	16.6%	13.5%	13.1%
		% of Total	4.6%	2.5%	6.0%	13.1%
	Secondary	Count	191	24	173	388
		% within Type of School	47.2%	15.9%	39.0%	38.8%
		% of Total	19.1%	2.4%	17.3%	38.8%
	Primary	Count	62	4	30	96
		% within Type of School	15.3%	2.6%	6.8%	9.6%
		% of Total	6.2%	.4%	3.0%	9.6%
	Unknown	Count	93	39	111	243
		% within Type of School	23.0%	25.8%	25.0%	24.3%
		% of Total	9.3%	3.9%	11.1%	24.3%
Total		Count	405	151	444	1000
		% within Type of School	100.0%	100.0%	100.0%	100.0%
		% of Total	40.5%	15.1%	44.4%	100.0%

Table 4.7. *Mothers of the participants' occupation by type of school*

Mother's Occupation * Type of School Crosstabulation

			Type of School			
			Government-aided School	International School	DSS School	Total
Mother's Occupation	Self-employed/Owner	Count	20	27	45	92
		% within Type of School	4.9%	17.9%	10.1%	9.2%
		% of Total	2.0%	2.7%	4.5%	9.2%
	Professional	Count	22	34	56	112
		% within Type of School	5.4%	22.5%	12.6%	11.2%
		% of Total	2.2%	3.4%	5.6%	11.2%
	Technical	Count	1	6	5	12
		% within Type of School	.2%	4.0%	1.1%	1.2%
		% of Total	.1%	.6%	.5%	1.2%
	Clerical	Count	45	18	67	130
		% within Type of School	11.1%	11.9%	15.1%	13.0%
		% of Total	4.5%	1.8%	6.7%	13.0%
	Manual	Count	39	0	14	53
		% within Type of School	9.6%	.0%	3.2%	5.3%
		% of Total	3.9%	.0%	1.4%	5.3%
	Housewife/Homemaker	Count	244	39	184	467
		% within Type of School	60.2%	25.8%	41.4%	46.7%
		% of Total	24.4%	3.9%	18.4%	46.7%
	Retired	Count	0	1	1	2
		% within Type of School	.0%	.7%	.2%	.2%
		% of Total	.0%	.1%	.1%	.2%
	Unemployed	Count	0	2	1	3
		% within Type of School	.0%	1.3%	.2%	.3%
		% of Total	.0%	.2%	.1%	.3%
	Unknown	Count	34	24	71	129
		% within Type of School	8.4%	15.9%	16.0%	12.9%
		% of Total	3.4%	2.4%	7.1%	12.9%
Total		Count	405	151	444	1000
		% within Type of School	100.0%	100.0%	100.0%	100.0%
		% of Total	40.5%	15.1%	44.4%	100.0%

Table 4.8. *Number of siblings of the participants by type of school*

Number of Siblings * Type of School Crosstabulation

			Type of School			
			Government-aided School	International School	DSS School	Total
Number of Siblings	Only Child	Count	56	24	106	186
		% within Type of School	13.8%	15.9%	23.9%	18.6%
		% of Total	5.6%	2.4%	10.6%	18.6%
	1	Count	209	78	209	496
		% within Type of School	51.6%	51.7%	47.2%	49.6%
		% of Total	20.9%	7.8%	20.9%	49.6%
	2	Count	81	36	82	199
		% within Type of School	20.0%	23.8%	18.5%	19.9%
		% of Total	8.1%	3.6%	8.2%	19.9%
	3	Count	41	8	30	79
		% within Type of School	10.1%	5.3%	6.8%	7.9%
		% of Total	4.1%	.8%	3.0%	7.9%
	4	Count	9	3	7	19
		% within Type of School	2.2%	2.0%	1.6%	1.9%
		% of Total	.9%	.3%	.7%	1.9%
	5	Count	6	1	6	13
		% within Type of School	1.5%	.7%	1.4%	1.3%
		% of Total	.6%	.1%	.6%	1.3%
	6 or more	Count	3	1	3	7
		% within Type of School	.7%	.7%	.7%	.7%
		% of Total	.3%	.1%	.3%	.7%
Total		Count	405	151	443	999
		% within Type of School	100.0%	100.0%	100.0%	100.0%
		% of Total	40.5%	15.1%	44.3%	100.0%

Table 4.9 *Type of residence of the participants by type of school*

Type of Residence * Type of School Crosstabulation

			Type of School			
			Government-aided School	International School	DSS School	Total
Type of Residence	Public Estate Housing	Count	219	5	103	327
		% within Type of School	54.1%	3.3%	23.3%	32.8%
		% of Total	21.9%	.5%	10.3%	32.8%
	Privately Owned Housing	Count	163	97	258	518
		% within Type of School	40.2%	64.2%	58.4%	51.9%
		% of Total	16.3%	9.7%	25.9%	51.9%
	Privately Rented Housing	Count	23	49	81	153
		% within Type of School	5.7%	32.5%	18.3%	15.3%
		% of Total	2.3%	4.9%	8.1%	15.3%
Total		Count	405	151	442	998
		% within Type of School	100.0%	100.0%	100.0%	100.0%
		% of Total	40.6%	15.1%	44.3%	100.0%

Table 4.10. *Primary language or dialect students spoke at home by type of school*

Language at Home * Type of School Crosstabulation

			Type of School			
			Government-aided School	International School	DSS School	Total
Language at Home	Cantonese	Count	399	125	423	947
		% within Type of School	98.5%	82.8%	95.5%	94.8%
		% of Total	39.9%	12.5%	42.3%	94.8%
	Mandarin/Dialects	Count	5	12	14	31
		% within Type of School	1.2%	7.9%	3.2%	3.1%
		% of Total	.5%	1.2%	1.4%	3.1%
	English	Count	1	12	6	19
		% within Type of School	.2%	7.9%	1.4%	1.9%
		% of Total	.1%	1.2%	.6%	1.9%
	Others	Count	0	2	0	2
		% within Type of School	.0%	1.3%	.0%	.2%
		% of Total	.0%	.2%	.0%	.2%
Total		Count	405	151	443	999
		% within Type of School	100.0%	100.0%	100.0%	100.0%
		% of Total	40.5%	15.1%	44.3%	100.0%

The Measurement of Students' Motivation towards Science

Analysis of the Motivation Questionnaire

The participating students completed a questionnaire that was designed to measure their motivation towards Science. The questionnaire consisted of 29-items based on a 6-point scale, rated from one to six ("1" for strongly disagree with the statement, "2" for disagree, "3" for somewhat disagree, "4" for somewhat agree, "5" for agree, "6" for strongly agree). Afterwards, data of the 29 motivational items was analysed and divided into two sections to measure their reliabilities and correlations. The first part was presented by using the internal consistency estimates of reliability with Cronbach's coefficient alphas to measure the consistency for each of the constructs. The second section was the calculation of Pearson Product-Moment correlation coefficients between the five motivational measures.

Internal Consistency Reliability with Cronbach's Coefficient Alpha

To assess whether the 29 items could be summed to create a reliable motivation scales, Cronbach's alphas were computed. Item analyses were conducted on the hypothesised 29 items to assess the motivational constructs to test for reliability and validity. The results showed that one item had low correlations with its own attitude towards Science construct; and thus, was eliminated to improve the reliability: (Item Q4_4r) "I don't feel happy about my Science work". Coefficient alphas were computed for the revised 28-item scale to obtain the internal reliability for each of these motivational constructs. Table 4.11 displays the list of the Cronbach's coefficient alphas for each of the motivational dimension. After removing that item, the new Cronbach's alpha coefficients were higher than the

acceptable coefficient level of 0.7 (Nunnally, 1978). It indicates that the items form a scale that has reasonable internal consistency reliability.

Table 4.11. *The list of Cronbach's coefficient alphas for internal consistency estimates of reliability on the five constructs*

Motivational Dimension	Number of Item	Cronbach's Coefficient Alpha
Learning Goal	4	0.81
Performance Goal	4	0.76
Learned Helplessness	4	0.87
Attitude towards Science	6	0.82
Self-efficacy beliefs	10	0.81

Achievement Goal Orientation. There were eight items for measuring two achievement goal orientations. Learning goal included four items Q3_1, Q3_2, Q3_3 and Q3_4 with an alpha of 0.81, showing a high internal reliability. A high reliability alpha, 0.76, for performance goal, was obtained from four items Q5_1, Q5_2, Q5_3 and Q5_4.

Negative Motivation. There were four items for measuring one negative motivational dimension. Learned helplessness showed a very high reliability with the alpha value of 0.87 from four items Q2_5, Q2_6, Q2_7 and Q2_8.

Attitude towards Science. The Cronbach's alpha for attitude towards Science was 0.82. This high reliability obtained from six items Q4_1, Q4_2, Q4_3, Q4_5r, Q4_6r and Q4_7r.

Positive Motivation. Self-efficacy beliefs construct also showed a high value of Cronbach's alpha, 0.81, from ten items Q1_1, Q1_2, Q1_3, Q1_4, Q1_5, Q1_6r. Q1_7r, Q1_8r, Q1_9r and Q1_10r.

Pearson Product-Moment Correlation Coefficients

Correlation coefficients were computed among the motivational dimensions. The results of the correlational analyses presented in Table 4.12 show that all ten correlation coefficients were statistically significant. In general, the results suggest that these motivational dimensions were intercorrelated with three patterns: (i) the negative motivational items showed strong positive correlations with each other; (ii) the positive motivational items had strong correlations among them, and (iii) the negative motivation items were inversely correlated to the positive motivation items.

Self-efficacy beliefs were very strongly and positively correlated to attitude towards Science ($r = 0.70$, $p < 0.001$) and holding a learning goal ($r = 0.59$, $p < 0.001$); and mildly positively correlated to performance goal ($r = 0.11$, $p < 0.001$). Furthermore, self-efficacy also showed very strong inverse relationship with learned helplessness ($r = -0.68$, $p < 0.001$). Attitudes towards Science were very strongly and positively correlated to self-efficacy beliefs ($r = 0.70$, $p < 0.001$) and learning goal ($r = 0.56$, $p < 0.001$), mildly positively correlated to performance goal ($r = 0.11$, $p < 0.001$), and a very strong inverse relationship with learned helplessness. Performance goal had positive correlations to learning goal ($r = 0.24$, $p < 0.001$) and attitude towards Science ($r = 0.11$, $p = 0.001$). Learning goal had a very strong positive relationship with attitude towards Science ($r = 0.56$, $p < 0.001$) and self-efficacy beliefs ($r = 0.59$, $p < 0.001$), and had positive correlation with performance goals ($r = 0.24$, $p < 0.001$). On the other hand, learning goals showed an inversely strong correlation with learned helplessness ($r = -0.39$, $p < 0.001$). Learned helplessness displayed very strong inverse correlations to self-efficacy beliefs ($r = -0.68$, $p < 0.001$) and attitudes towards Science ($r = -0.56$, $p < 0.001$).

Table 4.12. *Pearson correlation coefficient matrix between the five motivational constructs*

Dimension	Performance Goal	Learned Helplessness	Attitude towards Science	Self-efficacy beliefs
Learning Goal	.24**	-.39**	.56**	.59**
Performance Goal	-	-.08*	.11*	.08*
Learned Helplessness		-	-.56**	-.68**
Attitude towards Science			-	.70*
Self-efficacy beliefs				-

** Correlation is significant at the 0.01 level. * Correlation is significant at the 0.05 level.

Conclusion

The above analyses of reliability and correlation illustrate high internal consistency in the motivational dimensions and strong correlations among the motivational measures of the questionnaire developed in this study. Those five constructs of the questionnaire are therefore considered a reliable instrument to measure students' motivation towards Science in the junior secondary schools of Hong Kong context.

CHAPTER FIVE

RESULTS (PART II)

Part II. Data Analysis on the Hypotheses and Research Questions

This chapter is organised to present the results and analyses around the four research questions and six hypotheses discussed in chapter three. The analysis and interpretations are based on the results from the research questionnaire and the theoretical motivational dimensions.

Research Question (1): There is strong evidence indicating a decline in motivation over the transfer from primary to secondary schools. Will there be lower science motivation among higher year levels of Chinese junior secondary students in the Hong Kong context? If there is lower science motivation, how do junior secondary students from different types of schools demonstrate various patterns of motivation?

Research Hypothesis (1): Form 3 students will have lower motivation than Form 1 students in junior secondary schools in the Hong Kong context.

Two one-way analyses of variance were applied to respond to Research Question (1) and Research Hypothesis (1).

Comparing Year level on Motivational measures

A series of one-way analysis of variance was conducted to evaluate the relationship between the motivational dimensions and year level. The independent variable, year level, included three levels: Form 1, Form 2 and Form 3. The dependent variables were the motivational dimensions of the students. Performance goal was not statistically significant. The four dimensions that showed significant differences between

year levels are learning goal, $F(2, 997) = 8.61$, $p < 0.001$, partial $\eta^2 = 0.02$; learned helplessness, $F(2, 997) = 5.33$, $p < 0.01$, partial $\eta^2 = 0.01$; attitude towards Science, $F(2, 997) = 6.45$, $p < 0.01$, partial $\eta^2 = 0.01$; and self-efficacy beliefs, $F(2, 997) = 23.60$, $p < 0.001$, partial $\eta^2 = 0.05$. Follow-up tests were conducted to evaluate pairwise differences among the means for those four significant motivational dimensions. A one-way analysis of variance table comparing mean scores, standard deviations and effect sizes on motivational measures by year level are reported in Table 5.1. There were significant differences in the means between the three year levels among those four dimensions. The pairwise results showed that students in Form 3 showed significant differences from Form 1 students within all of the significant dimensions.

Form 3 students exhibited significant differences on all four significant dimensions to Form 1 students. Form 3 students demonstrated lower mean scores than Form 1 students on positive motivation of learning goal and self-efficacy beliefs, and less positive attitude towards Science. Furthermore, Form 3 students displayed higher the negative motivation of learned helplessness than Form 1 students. In short, Form 3 students showed stronger negative motivation and lower positive motivational influence than Form 1 students. The results were consistent with Research Hypothesis (1) and indicated that Form 3 students demonstrated lower motivation in Science than Form 1 junior secondary students.

Type of School on Motivational dimensions

Viewing the lower motivation in Science how would the Chinese junior secondary students exhibit different patterns in Science motivation in different types of school in Hong Kong? A one-way analysis of variance was conducted to evaluate the relationship between motivational dimensions and type of school. The independent variable, school type factor, included three types: government-aided schools, international schools and DSS schools. The dependent variables were the motivational dimensions of the students. Learning goal did not show any significant differences between schools. The other four dimensions showed significant differences: performance goal, $F(2, 997) = 9.36$, $p < 0.001$, partial $\eta^2 = 0.02$; learned helplessness, $F(2, 997) = 12.43$, $p < 0.001$, partial $\eta^2 = 0.02$; attitude towards Science, $F(2, 997) = 4.38$, $p = 0.013$, partial $\eta^2 = 0.01$; and self-efficacy beliefs, $F(2, 997) = 4.78$, $p = 0.009$, partial $\eta^2 = 0.01$. Cohen (1988) suggests when the values of η^2 are equal or larger than 0.01, 0.06 and 0.14, the effects are small, medium and large, respectively. Follow-up tests were conducted to evaluate pairwise differences among the means for these four motivational dimensions. There were significant differences in the means between the three types of schools among these motivational dimensions. A one-way analysis of variance table comparing mean scores, standard deviations and effect sizes on motivational measures by type of school are reported in Table 5.2.

The junior secondary school students from different types of schools in Hong Kong displayed distinctive motivation patterns. DSS school students demonstrated significantly higher negative motivation in terms of learned helplessness compared to the students from international schools. They also had significantly higher extent of learned helplessness than the students from government-aided schools. On the other hand, international school students demonstrated significantly higher levels of performance goal, and more positive attitude towards Science than the students from DSS schools.

DSS school students also had significantly higher learned helplessness than the students from government-aided schools. In contrast, students from the international schools showed significantly higher levels of performance goal and more positive attitude towards Science than the students from DSS schools. DSS school students also showed significantly higher levels of learned helplessness than the students from government-aided schools.

Table 5.1. *One-way analysis of variance table comparing mean scores, standard deviations and effect sizes on motivational measures by year level (N=1000 for all sample; n = 388 for Form 1; n =285 for Form 2; n = 327 for Form 3)*

Dimension	Mean			SD			ANOVA	Effect Size
	Form 1	Form 2	Form 3	Form 1	Form 2	Form 3	*F*-value	Partial η^2
Learning Goal	4.28	4.01	4.09	0.90	0.81	0.84	8.61***	0.02
Performance Goal	3.87	3.71	3.77	1.09	0.95	0.94	NS	<0.01
Learned Helplessness	2.27	2.44	2.51	1.00	1.03	1.00	5.33**	0.01
Attitude towards Science	4.15	4.01	3.91	0.94	0.91	0.91	6.45**	0.01
Self-efficacy Beliefs	4.25	4.00	3.89	0.70	0.71	0.71	23.60***	0.05

*** Significance at the 0.001 level. ** Significance at the 0.01 level. NS represents non-significance.

Table 5.2. *One-way analysis of variance table comparing mean scores, standard deviations and effect sizes on motivational measures by type of school (N=1000 for all schools; n=405 for government-aided schools; n=151 for international schools; n=444 for DSS schools)*

Dimension	Mean			SD			ANOVA	Effect Size
	GAS	IS	DSS	GAS	IS	DSS	*F*-value	Partial η^2
Learning Goal	4.20	4.16	4.08	0.80	0.93	0.89	NS	<0.01
Performance Goal	3.71	4.11	3.76	1.00	1.09	0.97	9.36***	0.02
Learned Helplessness	2.36	2.08	2.54	0.95	1.02	1.04	12.43***	0.02
Attitude towards Science	4.03	4.23	3.97	0.90	0.97	0.93	4.38*	0.01
Self-efficacy beliefs	4.09	4.19	3.99	0.67	0.77	0.75	4.76**	0.01

*** Significance at the 0.001 level. ** Significance at the 0.01 level. * Significance at the 0.05 level. NS represents non-significance.

Research Question (2): What are the relationships between age and motivation in junior secondary students? Do older junior secondary students exhibit stronger learned helplessness, lower positive motivation (learning goal and self-efficacy), and less positive attitudes towards Science than younger junior secondary students?

Research Hypothesis (2): Relative to younger junior secondary students (Age 11 and 12), older junior secondary students (Age 14 and 15) are predicted to demonstrate stronger learned helplessness, lower positive motivation (learning goal and self-efficacy), and less positive attitudes towards Science.

A one-way analysis of variance was used in analysing Research Question (2) and Research Hypothesis (2).

Comparing Age on Motivational measures

A one-way analysis of variance was conducted to evaluate the relationship between motivational dimensions and age of participants. The independent variable, age of participants, included six groups: 11, 12, 13, 14, 15, and 16 or older. The dependent variables were the motivational dimensions. Age was significant for all motivational dimensions: learning goal, $F(5, 994) = 2.34$, $p < 0.05$, partial $\eta^2 = 0.01$; performance goal, $F(5, 994) = 4.40$, $p = 0.001$, partial $\eta^2 = 0.02$; learned helplessness, $F(5, 994) = 2.55$, $p < 0.05$, partial $\eta^2 = 0.01$; attitude towards Science, $F(5, 994) = 2.73$, $p < 0.05$, partial $\eta^2 = 0.01$; and self-efficacy beliefs, $F(5, 994) = 5.61$, $p < 0.001$, partial $\eta^2 = 0.03$. According to Cohen (1988), all of these partial η^2 values indicate small effect sizes. Follow-up tests were conducted to evaluate pairwise differences among the means for the motivational dimensions. Learned helplessness and learning goal were not significantly different between the six age groups although

these were significant as independent variables. A one-way analysis of variance table comparing mean scores, standard deviations and effect sizes on motivational dimensions by the six age groups are reported in Table 5.3. The older students, aged 14 and 15, had significantly lower self-efficacy beliefs than the younger students aged 11, 12 and 13. Students aged 15 showed significantly less positive attitude towards Science than the students aged 12. The older students, aged 13, 14 and 16 or old, demonstrated significantly poorer mean scores on the performance goals than the younger students aged 11 and 12. Figure 5.1 illustrates an inverse relationship between the age of students and motivational dimensions of performance goal and attitude towards Science. To sum up, the results were parallel to Research Hypothesis (2). Generally speaking, the older junior secondary students exhibited higher learned helplessness (Figure 5.2) and lower positive motivation (Figure 5.3), and less positive attitudes towards Science (Figure 5.1) than the younger ones.

Table 5.3. *One-way analysis of variance table comparing mean scores, standard deviations and effect sizes on motivational dimensions by age (N = 1000; n = 20 for age of 11; n = 208 for age of 12; n = 267 for age of 13; n = 291 for age of 14; n = 172 for age of 15; n = 42 for age of 16 or older)*

Dimension	Age	Mean	Std. Deviation	ANOVA *F*-value	Effect Size Partial η^2
Learning Goal	11	4.24	1.02	2.34*	0.01
	12	4.24	0.87		
	13	4.23	0.87		
	14	4.05	0.85		
	15	4.07	0.83		
	16 or older	4.01	0.85		
Performance Goal	11	4.45	0.99	4.40**	0.02
	12	3.95	1.12		
	13	3.76	0.98		
	14	3.71	0.95		
	15	3.80	0.97		
	16 or older	3.43	0.94		
Learned Helplessness	11	1.98	1.05	2.55*	0.01
	12	2.31	1.04		
	13	2.32	0.97		
	14	2.46	1.03		
	15	2.57	1.01		
	16 or older	2.36	0.92		
Attitude towards Science	11	4.38	1.16	2.73*	0.01
	12	4.15	0.96		
	13	4.08	0.90		
	14	3.98	0.91		
	15	3.87	0.94		
	16 or older	3.98	0.76		
Self-efficacy Beliefs	11	4.39	0.84	5.61***	0.03
	12	4.16	0.72		
	13	4.17	0.72		
	14	3.97	0.74		
	15	3.91	0.67		
	16 or older	4.00	0.64		

*** Significance at the 0.001 level. ** Significance at the 0.01 level. * Significance at the 0.05 level.

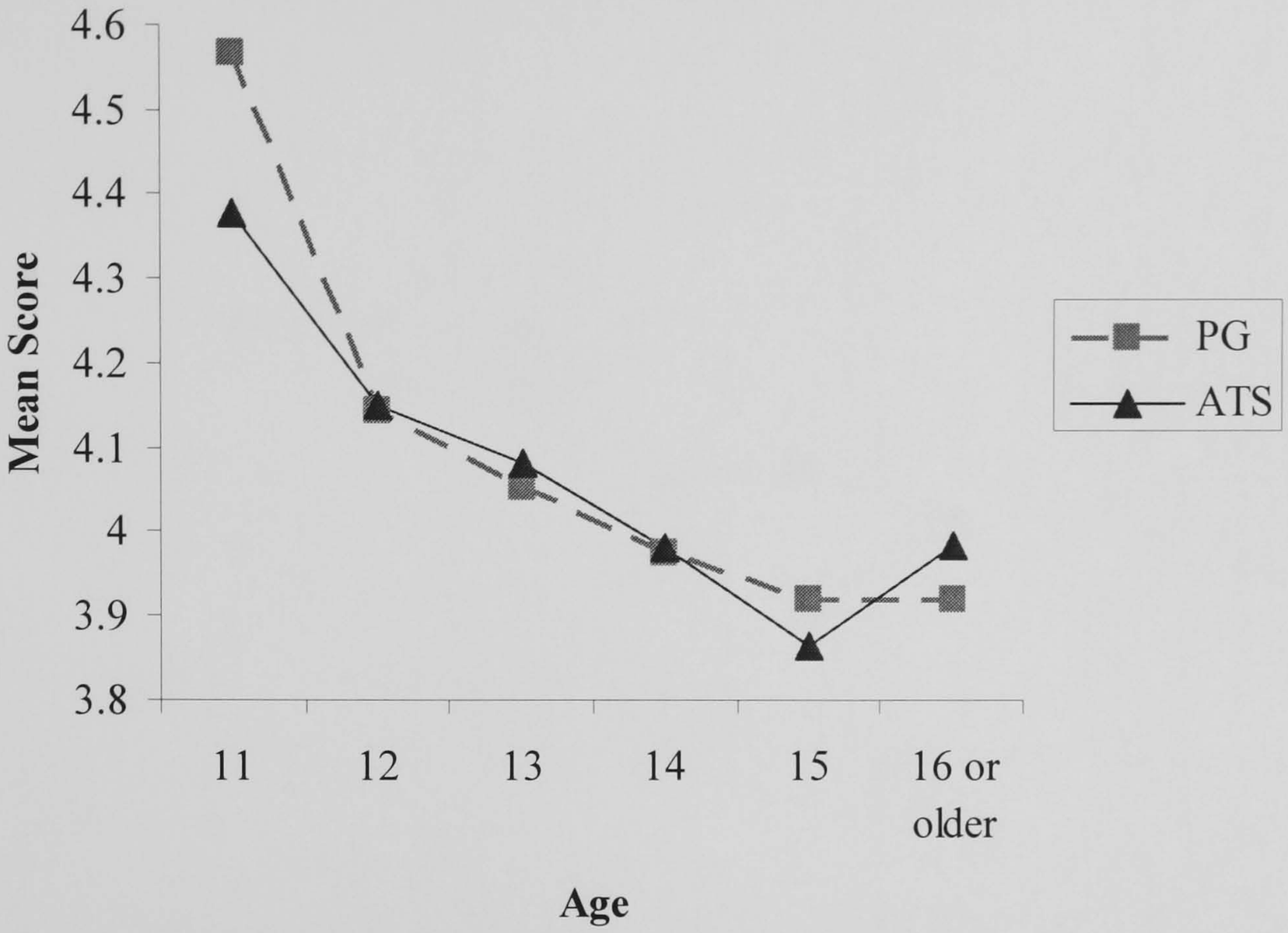

Figure 5.1. Mean plot of age on performance goal (PG) and attitude towards Science (ATS)

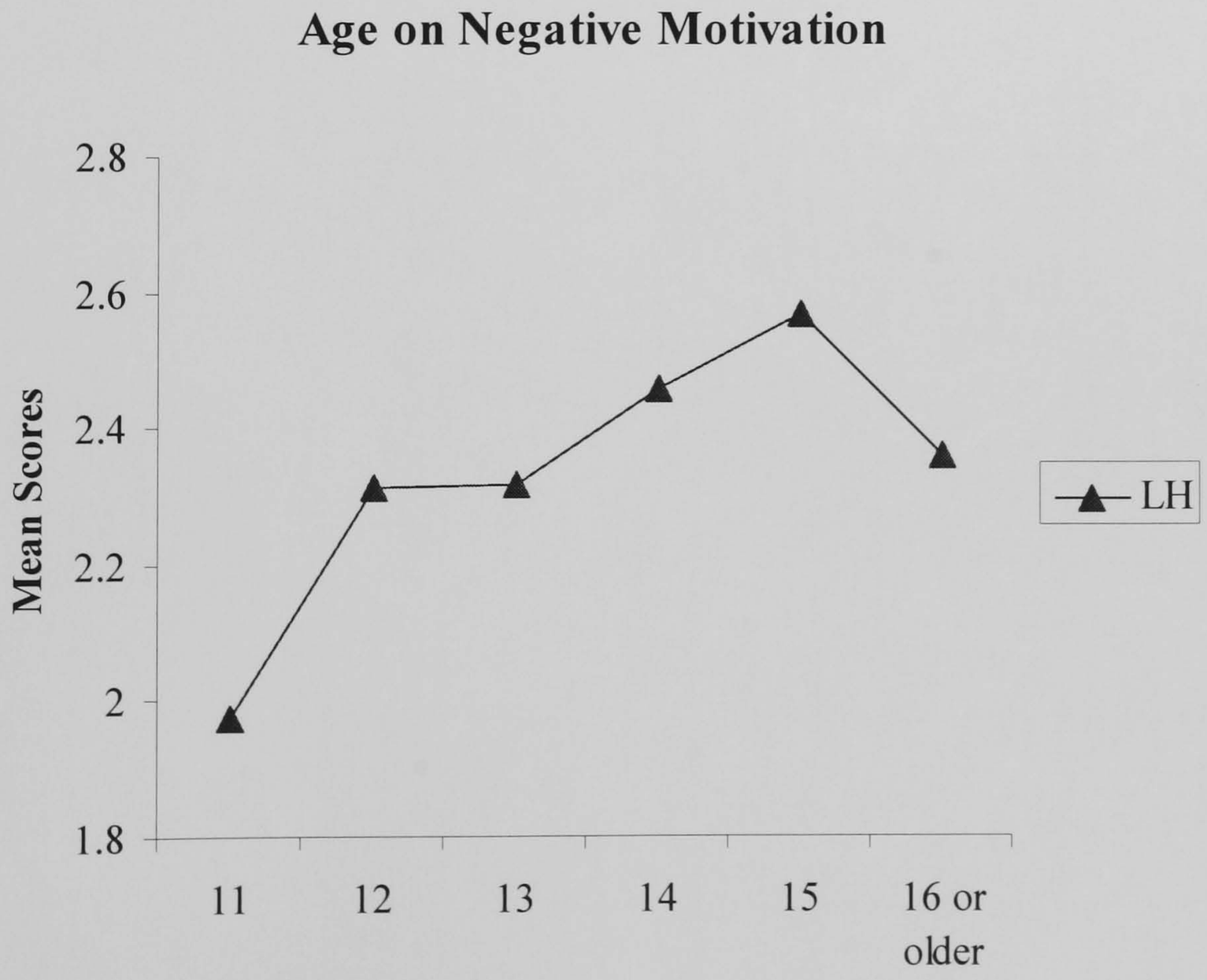

Figure 5.2. Mean plots of age on negative motivation of learned helplessness (LH)

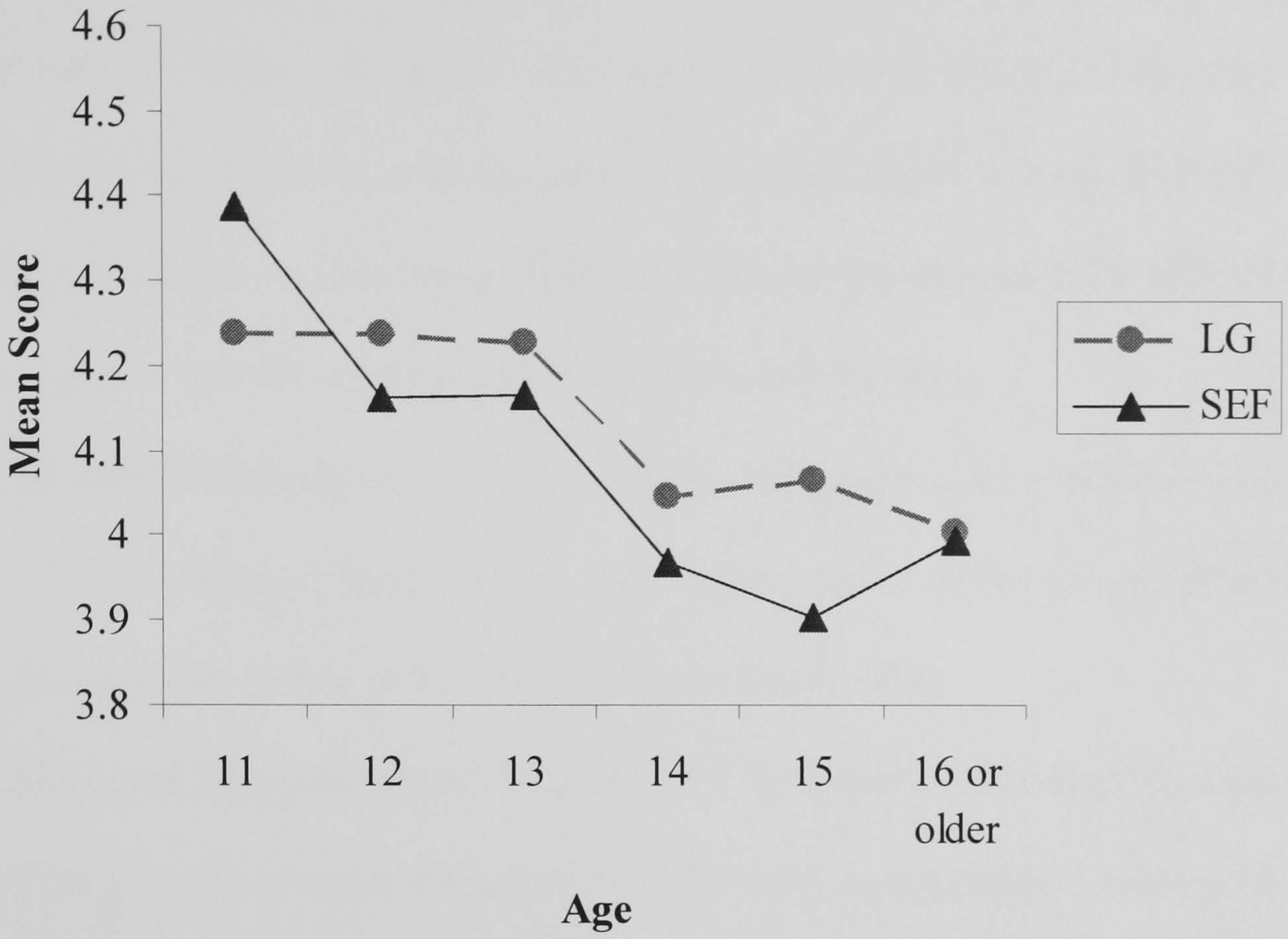

Figure 5.3. Mean plots of age on the positive motivation of learning goal (LG) and self-efficacy (SEF)

Research Question (3): What are the relationships between Science achievement and student characteristics (year level and type of school), and Science achievement and motivation? What is the major motivational factor contributing to Science achievement? In particular, poor Science achievement might be a predictor of learned helplessness, or vice versa. Higher Science achievement might predict higher degrees of positive motivation in Science, or vice versa.

Research Hypothesis (3): There will be a negative correlation between year level and Science achievement. The higher year level the junior secondary students, the lower their Science achievement will be.

Research Hypothesis (4): There will be a negative correlation between Science achievement and negative motivation, and a positive correlation between Science achievement and positive motivational influence. The poorer the junior secondary students' Science achievement, the higher the degrees of learned helplessness will be. On the other hand, the better the Science achievement, the higher the degrees of learning goal, self-efficacy and attitude towards Science.

In responding to Research Question (3) and Research Hypotheses (3) and (4), a two-way analysis of variance and a series of simultaneous regression analyses were applied.

Year Level and Type of School on Science Achievement

A 3 × 3 ANOVA was conducted to analyse the effects of year level and type of school on Science achievement. The dependent variable was the Science achievement students received from their mid-term report card. The two independent variables are year level factor (including three junior secondary year

levels: Form 1, Form 2 and Form 3) and type of school factor (including three types of school: government-aided, international and DSS schools). The means and standard deviations for Science achievement as a function of the two factors are shown in Table 5.4 and 5.5. Figure 5.4 demonstrates the mean scores of Science achievement by year level. Figure 5.5 illustrates mean scores of Science achievement grade by type of school and year level. International schools showed the highest Science achievement mean scores, government-aided schools the second, and DSS the lowest.

The results for the ANOVA indicated a significant main effect for year level, $F(2, 993) = 9.25$, $p < 0.001$, partial $\eta^2 = 0.02$, a significant main effect for type of school, $F(2, 993) = 40.44$, $p < 0.001$, partial $\eta^2 = 0.08$, and the interaction between year level and type of school was not significant, $F(4, 993) = 2.28$, $p < 0.059$, partial $\eta^2 = 0.01$. Follow-up *post hoc* pairwise comparisons were conducted to evaluate the differences among the means for each of the two factors. The year level variable results indicate that there were significant differences between Form 1 and Form 2, Form 1 and Form 3, but no significant differences between Form 2 and Form 3 students (see Table 5.4). For the type of school variable, the results showed significant differences between all three types of schools (see Table 5.5). In conclusion, the results showed consistency with Research Hypothesis (3) that the higher year levels the junior secondary students moved to, the lower their Science achievement was. There was a negative correlation between year level and Science achievement. Form 2 and Form 3 students experienced lower achievement in Science than Form 1 students in the junior secondary schools.

Table 5.4. *Number of participants, means, standard deviations and 95% confidence intervals of post hoc pairwise differences in means of Science achievement grade by year level*

Year Level	*n*	*Mean*	*SD*	Form 1	Form 2
Form 1	387	3.47	1.49	-	-
Form 2	284	3.03	1.43	0.17 to 0.70*	-
Form 3	327	2.87	1.60	0.32 to 0.87*	-0.13 to 0.45

Note: * indicates that the 95% confidence interval does not contain zero, and therefore the difference in means is significant at the 0.05 significance using Games-Howell procedure.

Table 5.5. *Number of participants, means, standard deviations and 95% confidence intervals of post hoc pairwise differences in means of Science achievement grade by type of school*

Type of School	*n*	*Mean*	*SD*	Government-aided school	International school
Government-aided school	405	3.25	1.39	-	-
International school	151	4.01	1.54	-1.10 to –0.43*	-
DSS school	442	2.76	1.57	0.25 to 0.72*	0.91 to 1.59*

Note: * indicates that the 95% confidence interval does not contain zero, and therefore the difference in means is significant at the 0.05 significance using Games-Howell procedure.

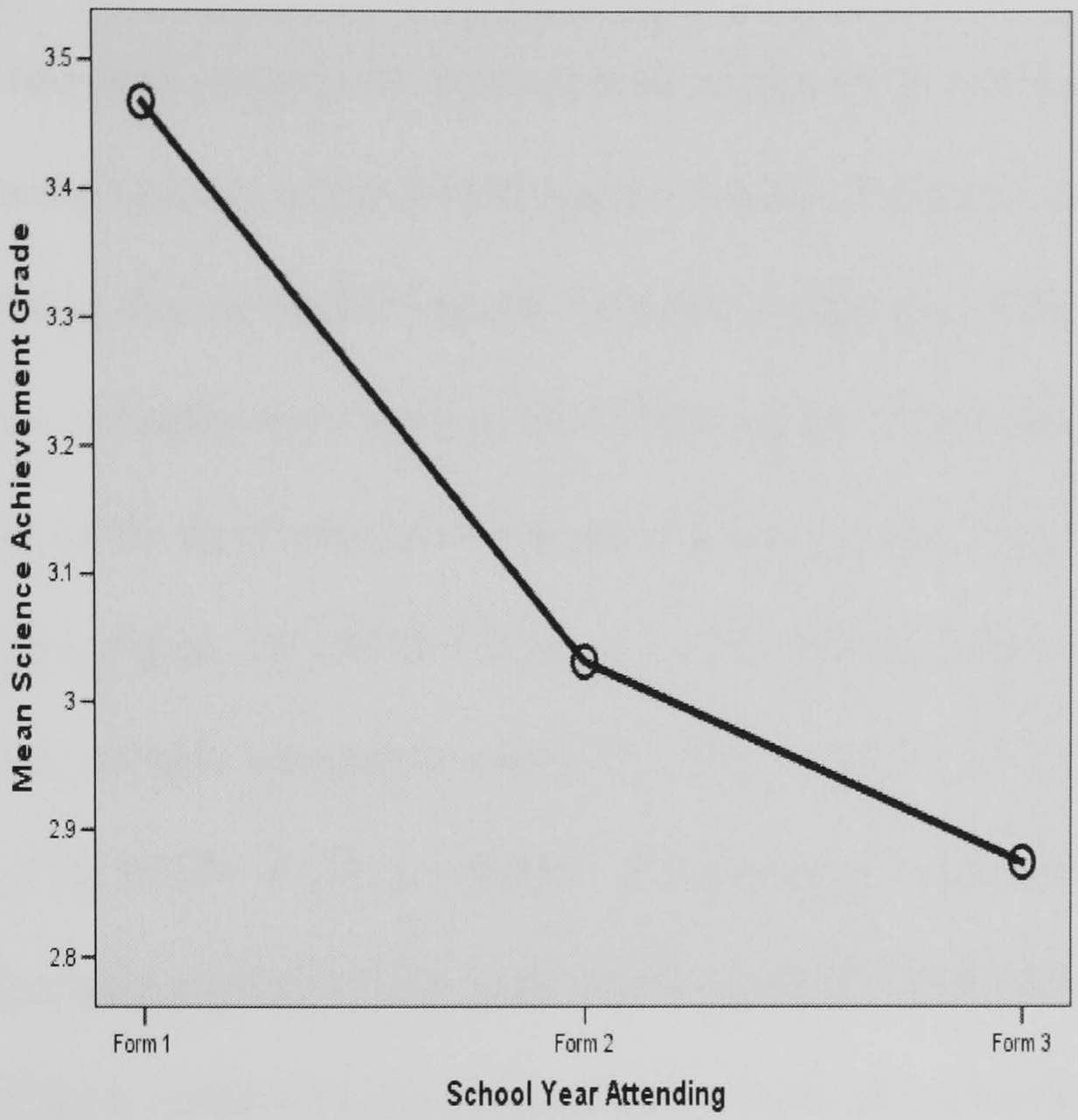

Figure 5.4. Science achievement by year level

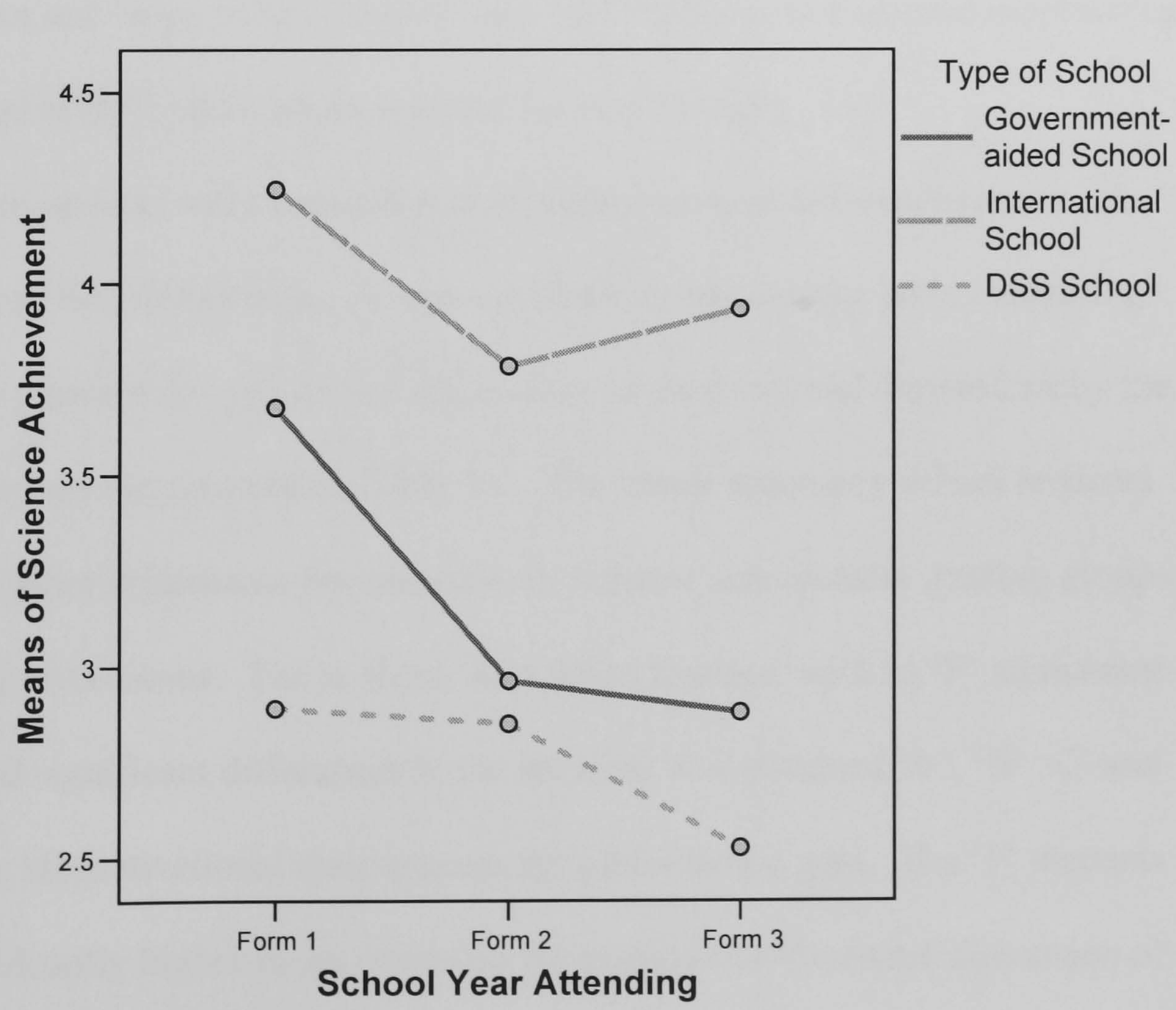

Figure 5.5. Mean scores of Science achievement grade by type of school and year level

Science Achievement and Motivational Measures

Another one-way analysis of variance was conducted to evaluate the relationship between Science achievement and motivational dimensions. The independent variable, Science achievement, included six groups: A, B, C, D, E, and F. The dependent variables were motivational dimensions. There were significant differences for all of the motivational dimensions: learning goal, $F(5, 992) = 19.59$, $p < 0.001$; performance goal, $F(5, 992) = 3.50$, $p < 0.01$; learned helplessness, $F(5, 992) = 32.47$, $p < 0.001$; attitude towards Science, $F(5, 992) = 31.20$, $p < 0.001$; and self-efficacy beliefs, $F(5, 992) = 45.31$, $p < 0.001$. The partial η^2 values of the measures are as follows: learning goal $\eta^2 = 0.09$, performance goal $\eta^2 = 0.02$, learned helplessness $\eta^2 = 0.14$, attitude towards Science $\eta^2 = 0.14$, and self-efficacy beliefs $\eta^2 = 0.19$. According to Cohen (1988), the η^2 values of 0.01, 0.06 and 0.14 represent small, medium and large effects, respectively. Self-efficacy and learned helplessness indicated large effects, and attitude towards Science medium.

Follow-up tests were conducted to evaluate pairwise differences among the means for those five dimensions. A one-way analysis of variance table comparing mean scores, standard deviations and effect sizes on motivational dimensions by the six grading groups are reported in Table 5.6. The junior secondary school students showed significant differences between the six Science achievement grading groups on all the five dimensions. The students who failed Science, with an 'F' attainment grade, showed significant differences to the students who obtained 'A', 'B' 'C' and 'D' grades on all motivational measures except performance goal. The 'F' students showed significantly higher mean scores on the negative motivational dimension of learned helplessness; and significantly lower mean scores on the positive motivational dimensions of science self-efficacy and learning goal. They also

demonstrated significantly less positive attitude towards Science and lower performance goal at 0.05 level. In contrast, the students who obtained 'A' grades displayed significantly higher performance goal than the students who received either 'C', 'D', 'E' or 'F' grades. In sum, the results in this study showed that Science achievement had a negative correlation pattern on negative motivation (Figure 5.6), a positive correlation pattern with positive motivation (Figure 5.7), attitude towards Science and performance goal (Figure 5.8).

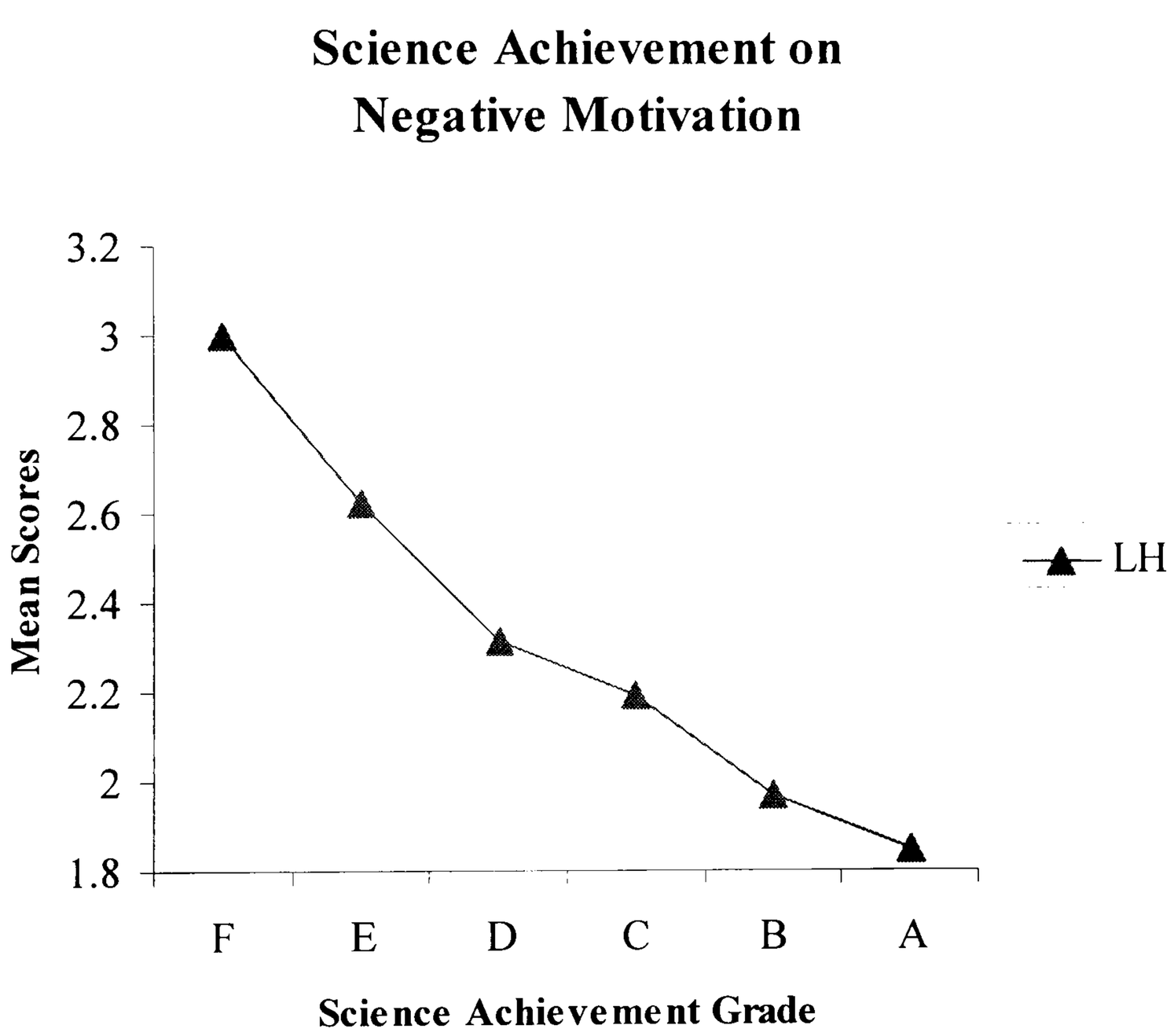

Figure 5.6. Mean plots of Science achievement grade on learned helplessness (LH)

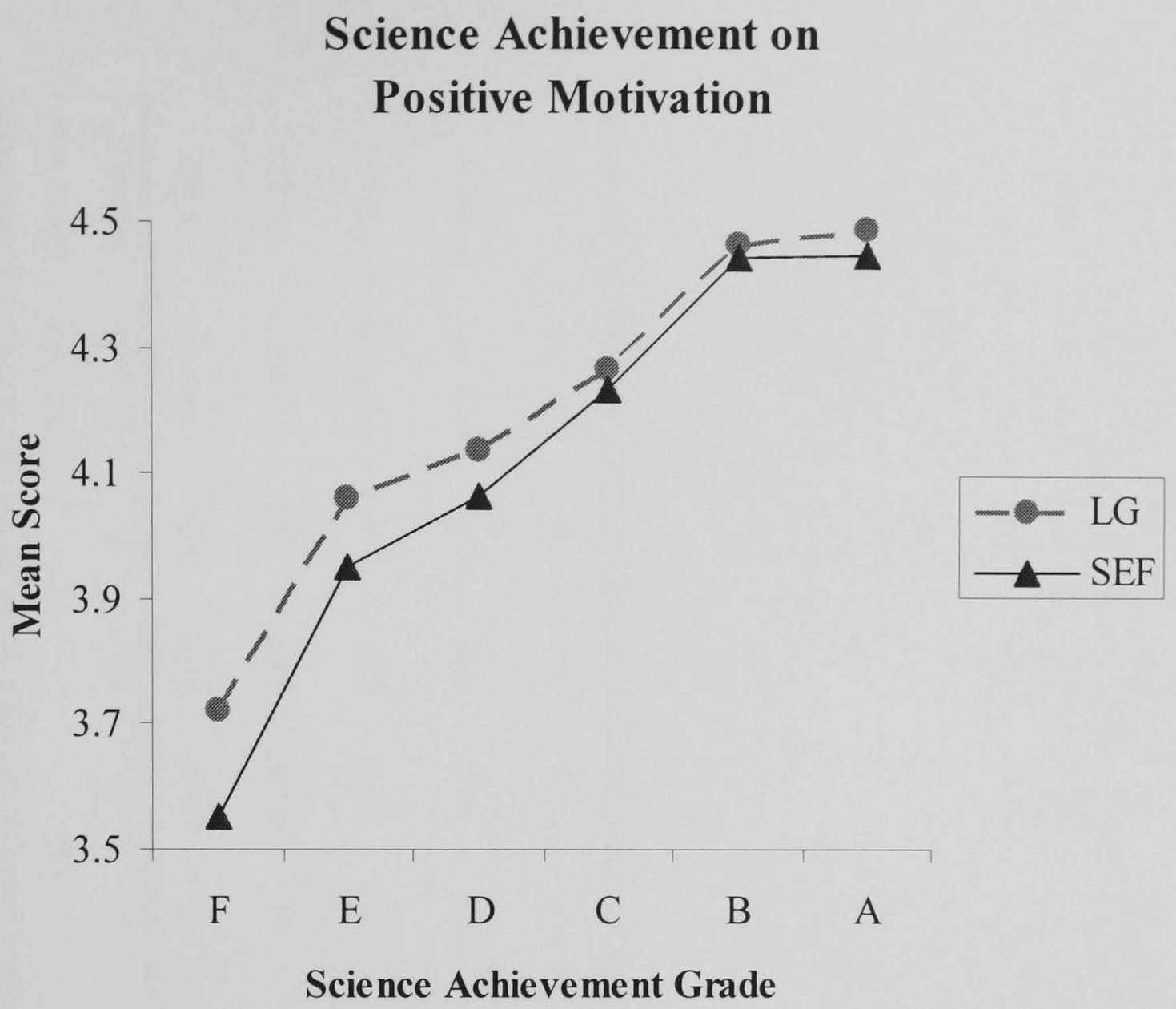

Figure 5.7. Mean plots of Science achievement grade on positive motivation of learning goal (LG) and self-efficacy (SEF)

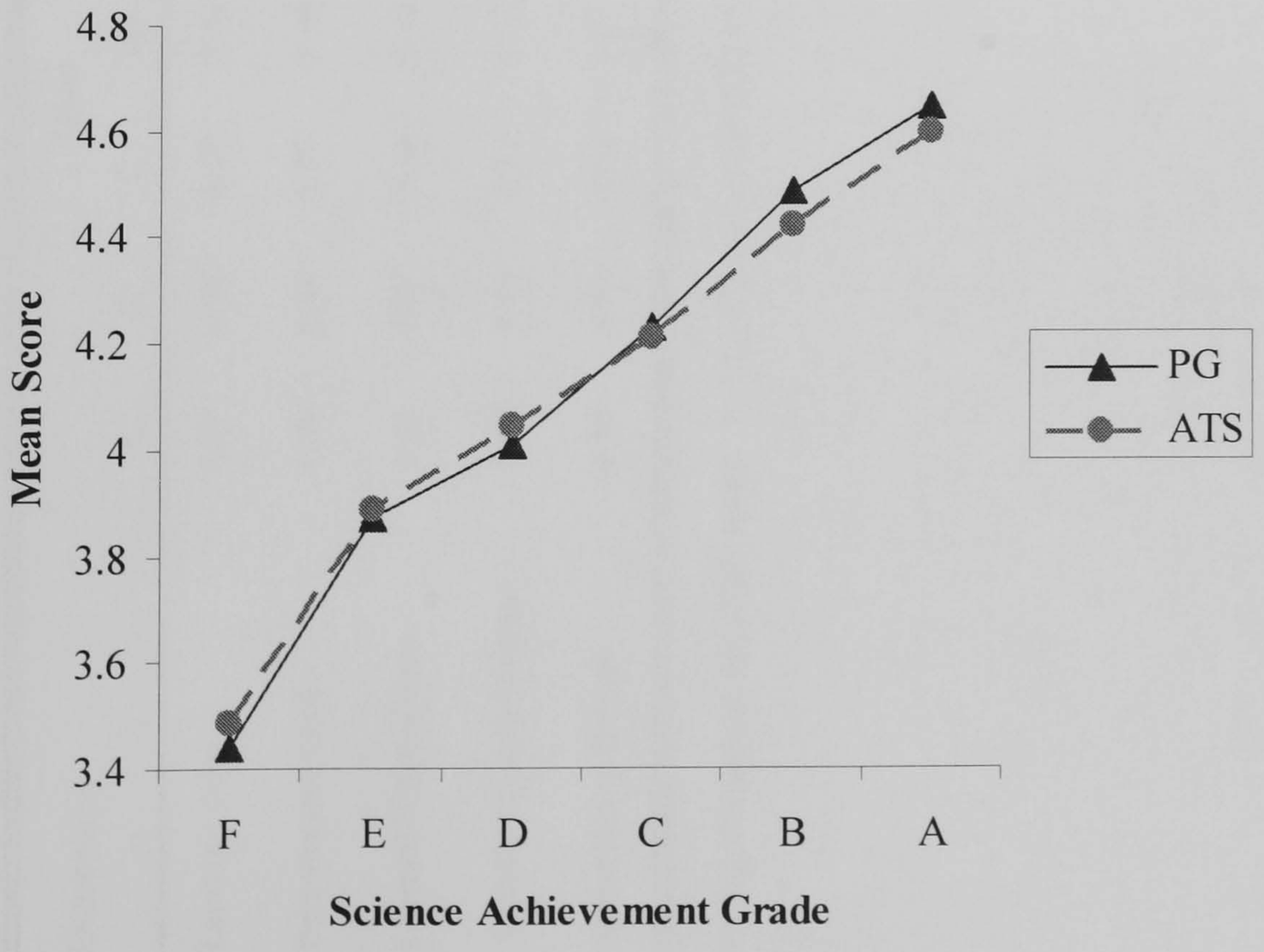

Figure 5.8. Mean plots of Science achievement grade on performance goal (PG) and attitude towards Science (ATS)

Table 5.6. *One-way analysis of variance table comparing mean scores, standard deviations and effect sizes on motivational measures by Science achievement grade (N=998 for all sample; n = 49 for A; n =170 for B; n = 234 for C; n = 191 for D; n =136 for E; n = 218 for F)*

Dimension	Mean						SD						ANOVA	Effect Size
	A	B	C	D	E	F	A	B	C	D	E	F	*F*-value	Partial η^2
Learning Goal	4.49	4.46	4.27	4.14	4.06	3.72	0.95	0.81	0.81	0.85	0.79	0.81	19.59***	0.09
Performance Goal	4.29	3.89	3.77	3.79	3.73	3.67	0.98	0.99	1.02	0.98	0.87	1.08	3.50**	0.02
Learned Helplessness	1.85	1.97	2.19	2.32	2.62	3.00	0.90	0.90	0.85	0.87	0.87	1.15	32.47***	0.14
Attitude towards Science	4.60	4.42	4.21	4.05	3.89	3.49	0.90	0.82	0.82	0.84	0.88	0.95	31.20***	0.14
Self-efficacy Beliefs	4.45	4.44	4.24	4.07	3.95	3.55	0.80	0.68	0.63	0.64	0.64	0.66	45.31***	0.19

*** Significance at the 0.001 level. ** Significance at the 0.01 level.

Simultaneous Regression of Student Characteristics in Predicting Science Achievement

Three simultaneous linear regressions were conducted to analyse how well year level, type of school and gender predicted Science achievement. The criterion variable was Science achievement grade. Dummy variables were used in these analyses because these variables include nominal data.

The variable, year level, significantly contributed to the prediction of Science achievement, $F(2, 995) = 8.26$, $p < 0.001$; however, the model showed a small variance. The adjusted R squared value was 0.014, indicating that 1.4% of the variance in Science achievement was explained by the model in Table 5.7. The type of school variable was also significantly related to the Science achievement grade, $F(2, 995) = 41.93$, $p < 0.001$. The adjusted R squared value was 0.076, indicating that 7.6% of the variance in Science achievement was explained by the model in Table 5.8. Although the variable, gender, also significantly contributed to the prediction of Science achievement grade, $F(1, 996) = 5.01$, $p < 0.025$, the model displayed a very small variance. The adjusted R squared value was 0.004, indicating that only 0.4% of the variance in Science achievement was explained by the model in Table 5.9. On the basis of these correlational analyses, it is concluded that year level, type of school and gender were only minor predictors for Science achievement.

Table 5.7. *Results of the simultaneous multiple regression analysis summary table by year level variable in predicting Science achievement*

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.128[a]	.016	.014	1.521	.016	8.263	2	995	.000

a. Predictors: (Constant), year2, year1

Table 5.8. *Results of the simultaneous multiple regression analysis summary table by type of school variable in predicting Science achievement*

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.279[a]	.078	.076	1.473	.078	41.929	2	995	.000

a. Predictors: (Constant), type2, type1

Table 5.9. *Results of the simultaneous multiple regression analysis summary table by gender variable in predicting Science achievement*

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.071[a]	.005	.004	1.529	.005	5.008	1	996	.025

a. Predictors: (Constant), Gender

Simultaneous Regression of Motivation Dimensions in Predicting Science Achievement

In the second analysis, a simultaneous linear regression was performed to analyse how well the motivational variables predicted Science achievement. The criterion variable was the Science achievement grade. The means, standard deviations and correlations of the variables can be found in Table 5.10 and 5.11. The linear combination of variables was significantly related to the Science achievement grade index, $F(5, 992) = 49.60$, $p < 0.001$, with four variables significantly contributing to the prediction. Learning goal did not significantly predict Science achievement grade in this model. The adjusted R squared value was 0.196, indicating that 19.6% of the variance in Science achievement grade was explained by the model. According to Cohen (1988), this is a small effect. The adjusted R squared values, beta weights and collinearity statistics presented in Table 5.12 and 5.13.

A series of five simultaneous linear regression analyses were conducted to measure how well each of the motivational measures individually predicted Science achievement. The criterion variable was the Science achievement grade. Self-efficacy beliefs (adjusted $R^2 = 0.175$, $\beta = 0.420$, $p < 0.001$) contributes the highest proportion of the variance (17.5%) in predicting Science achievement. The adjusted R squared value was 0.134 for learned helplessness ($\beta = 0.368$, $p < 0.001$), 0.131 for attitude towards Science ($\beta = 0.363$, $p < 0.001$), 0.084 for learning goal ($\beta = 0.292$, $p < 0.001$), and 0.010 for performance goal ($\beta = 0.106$, $p = 0.001$). Learned helplessness produced significant inverse relation for Science achievement. Learned helplessness and attitude towards Science contribute 13.4% and 13.1% of the variance, respectively, in predicting Science achievement. According to Cohen (1988), they nearly indicate small effects.

All Pearson's bivariate correlations between the five variables and Science achievement grade were statistically significant. Table 5.11 reports their correlations. There were concerns because two Pearson's bivariate correlation coefficients were higher than 0.6. They were -0.680 between self-efficacy beliefs and learned helplessness and 0.697 between self-efficacy beliefs and attitude towards Science. Nevertheless, multicollinearity concerns are possibly not significant if the bivariate correlation coefficient is lower than 0.7 (Wissmann, Toutenburg, & Shalab, 2007). The statistical problems caused by multicollinearity happen at 0.9 and higher (Tabachnick & Fidell, 1996). If the size of the sample is sufficiently large, the level of the acceptable correlation without having multicollinearity dilemma elevates (Shieh & Fouladi, 2003). Therefore, the multicollinearity problem cannot be entirely evaluated by the correlation coefficients alone. Examining the Tolerance and Variance Inflation Factor (VIF) for each variable in the regression model is a general approach for multicollinearity problem (Myers, 1990). Because there is no fixed rule for examining Tolerance and VIF, this study applied a common method utilising three rules. Rule (1): If the Tolerance index is below 0.1, there is a serious multicollinearity problem; rule (2): If the Tolerance index is below 0.2, there is a potential multicollinearity problem; and rule (3): If the VIF index is larger than 10, there is a concern. The collinearity diagnosis statistics in this study indicated that the smallest Tolerance index of the independent variables was 0.35, which is larger than 0.2; and no VIF index was greater than 2.89, which is much smaller than 10. Thus, there was little concern about multicollinearity in the regression model. On the basis of these correlational analyses, it is concluded that self-efficacy belief was the strongest predictor for Science achievement although learned helplessness attitude towards Science, and performance goal also contributed to the prediction.

Table 5.10. *Means and standard deviations of Science achievement grade and motivational dimensions (N = 998)*

Variable	Mean	Std. Deviation
Science Achievement Grade	3.15	1.53
Learning Goal	4.14	0.81
Performance Goal	3.79	1.01
Learned Helplessness	2.40	1.01
Attitude towards Science	4.03	0.93
Self-efficacy Beliefs	4.06	0.72

Table 5.11. *Pearson bivariate correlations between Science achievement and motivational predictors*

Dimension	Science Achievement Grade	Learning Goal	Performance Goal	Learned Helplessness	Attitude towards Science
Learning Goal	0.29**				
Performance Goal	0.11**	0.24**			
Learned Helplessness	-0.39**	-0.39**	-0.08*		
Attitude towards Science	0.36**	0.56**	0.11**	-0.56**	
Self-efficacy Beliefs	0.42**	0.59**	0.08*	-0.68**	0.697**

** Correlation is significant at the 0.01 level. * Correlation is significant at the 0.05 level.

Table 5.12. *Results of the simultaneous multiple regression analysis table of the variables in predicting Science achievement*

Model Summary

					Change Statistics		
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	Sig. F Change
1	.447[a]	.200	.196	1.374	.200	49.601	.000

a. Predictors: (Constant), Self-efficacy Beliefs, Performance Goal, Learning Goal, Learned Helplessness, Attitude towards Science

Table 5.13. *Beta weights and collinearity statistics of the simultaneous multiple regression analysis table of the variables in predicting Science achievement*

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	.403	.475		.847	.397		
	Learning Goal	.052	.067	.029	.784	.433	.571	1.750
	Performance Goal	.089	.045	.058	1.992	.047	.935	1.069
	Learned Helplessness	-.206	.060	-.136	-3.467	.001	.522	1.915
	Attitude towards Science	.168	.069	.102	2.446	.015	.467	2.141
	Self-efficacy Beliefs	.495	.102	.234	4.849	.000	.346	2.888

a. Dependent Variable: Science Achievement Grade

Science Achievement in Predicting Motivational Dimensions

A series of five simultaneous linear regression analyses was conducted to measure how well Science achievement predicted each of the motivational measures. The means and standard deviations of the variable are presented in Table 5.10. Science achievement grade significantly predicted each of the motivational dimensions: self-efficacy ($F(1, 996) = 212.77, p < 0.001; R^2 = 0.176$), learned helplessness ($F(1, 996) = 155.72, p < 0.001; R^2 = 0.135$), attitude towards Science ($F(1, 996) = 151.42, p < 0.001; R^2 = 0.132$), learning goal ($F(1, 996) = 92.89, p < 0.001; R^2 = 0.085$), and performance goal ($F(1, 996) = 11.34, p = 0.001; R^2 = 0.011$). The highest R squared value was 0.176 on self-efficacy, indicating that 17.6 % of the variance in Science achievement was explained by the model. According to Cohen (1988), 0.14 is already a small effect.

All the Pearson's bivariate correlations between Science achievement grade and the five variables were statistically significant and are reported in Table 5.11. The correlations between Science achievement and the positive motivation variables, self-efficacy ($r = 0.42, p < 0.001$), attitude towards Science ($r = 0.36, p < 0.001$) and learning goal ($r = 0.29, p < 0.001$) were all positively significant. Performance goal ($r = 0.11, p = 0.001$) was also significantly associated with Science achievement. On the other hand, the Pearson's bivariate correlations between Science achievement grade and learned helplessness ($r = -0.37, p < 0.001$) showed an inverse relation. Poorer Science achievement predicted higher degrees of the negative motivation, learned helplessness. The extent of learned helplessness decreased when Science achievement improved.

Summary

In conclusion, the results demonstrated significant differences in the means of Science achievement between the levels of Form 1 and Form 2, and Form 1 and Form 3. The higher the year level, the lower the Science achievement. This is consistent with Research Hypothesis (3). There was a negative correlation between Science achievement and year level. In addition, all three types of schools showed significant differences in Science achievement. Students at international schools had the highest Science achievement mean scores, government-aided schools the second, and DSS the lowest. However, these two students' characteristics, year level and type of school, were only minor predictors for Science achievement.

On the basis of the multiple regression analyses, it was concluded that self-efficacy was the strongest predictor among the motivation measures for Science achievement. All the motivational dimensions significantly predicted Science achievement. Vice versa, Science achievement significantly predicted all the motivation dimensions. The regression results showed an inverse correlation between Science achievement and negative motivation, and a parallel positive correlation between Science achievement and positive motivation. The results were consistent with Research Hypothesis (4). Poorer Science achievement predicted higher the degrees of learned helplessness. Higher Science achievement predicted higher degrees of the positive motivation measures of self-efficacy, attitude towards Science and learning goal.

Research Question (4): Based on Science achievement, will gender differences prevail in different year levels of junior secondary students? Will females display lower science motivation than males in Hong Kong's junior secondary schools?

Research Hypothesis (5): Males will outperform females in Science achievement.

Research Hypothesis (6): Females will demonstrate lower science motivation than males in Hong Kong's junior secondary schools.

In responding to Research Question (4), Research Hypothesis (5) and (6), a two-way analysis of variance and an independent *t*-test comparison were applied.

Gender and Year level on Science Achievement

A 2 × 3 ANOVA was performed to analyse the effects of gender and year level on Science achievement in the mid-term report card. The means and standard deviations for Science achievement as a function of the two factors are presented in Table 5.14. Figure 5.9 demonstrates the remarkable differences in the mean scores of Science achievement by gender and year level. The results for the ANOVA indicated a significant main effect for gender, $F(1, 992) = 24.35$, $p < 0.001$, a significant main effect for year level, $F(2, 992) = 13.65$, $p < 0.001$, and a significant interaction between gender and year level, $F(2, 992) = 5.63$, $p < 0.01$. The effect sizes for the analyses were calculated as an additional verification of the statistical validity of the data. Since the sample sizes are large in this study, small differences can pass significance tests (Olejnik & Algina, 2000). Olejnik and Algina (2000) suggest measuring the size of the treatment effects by using partial eta-squared (η^2). The partial η^2 values of the measures were as follows: gender $\eta^2 = 0.024$, year level

$\eta^2 = 0.027$, and between gender and year level $\eta^2 = 0.011$. According to Cohen (1988), those partial η^2 values indicate small effects.

Because the interaction between gender and year level was significant, the year level simple main effects are examined rather than the year level main effect, that is, the differences among year levels for males and females separately. To control for Type I error across the two simple main effects, the alpha was adjusted for each at 0.025. There were significant differences between year levels for females, $F(2, 992) = 17.50$, $p < 0.001$, but there was no significant differences for males. For each significant main effect, a follow-up test was conducted to evaluate the three pairwise differences among the means for females, with alpha set at 0.008 (0.025/3 = 0.008) to control for Type I error over the three pairwise comparisons. Females in Form 1 had significantly higher Science achievement results than the females in Form 2 and Form 3. There were no significant differences between the Form 2 and the Form 3 females.

The final analysis was conducted to address the hypothesis that females would experience lower achievement in Science than males in the higher junior secondary year levels. The results showed that there were significant differences in males and females between Form 1 and Form 2, and between Form 1 and Form 3 in Science achievement. The difference in means between Form 1 and Form 2 for males minus the difference in means between Form 1 and Form 2 for females was -0.71, $F(1, 992) = 9.36$, $p < 0.05$. The difference in means between Form 1 and Form 3 for males minus the difference in means between Form 1 and Form 3 for females was -0.58, $F(1, 992) = 6.66$, $p < 0.05$. The results of these comparisons were consistent with Research Hypothesis (5). Females experienced lower Science

achievement than males as they moved on after Form 1 level in junior secondary schools.

Table 5.14. *Means and standard deviations of Science achievement by gender and year level*

Student's Gender	School Year Attending	*N*	*Mean*	*Std. Deviation*
Boys	Form 1	210	3.49	1.59
	Form 2	144	3.40	1.38
	Form 3	143	3.22	1.63
Girls	Form 1	177	3.45	1.37
	Form 2	140	2.65	1.39
	Form 3	184	2.60	1.53

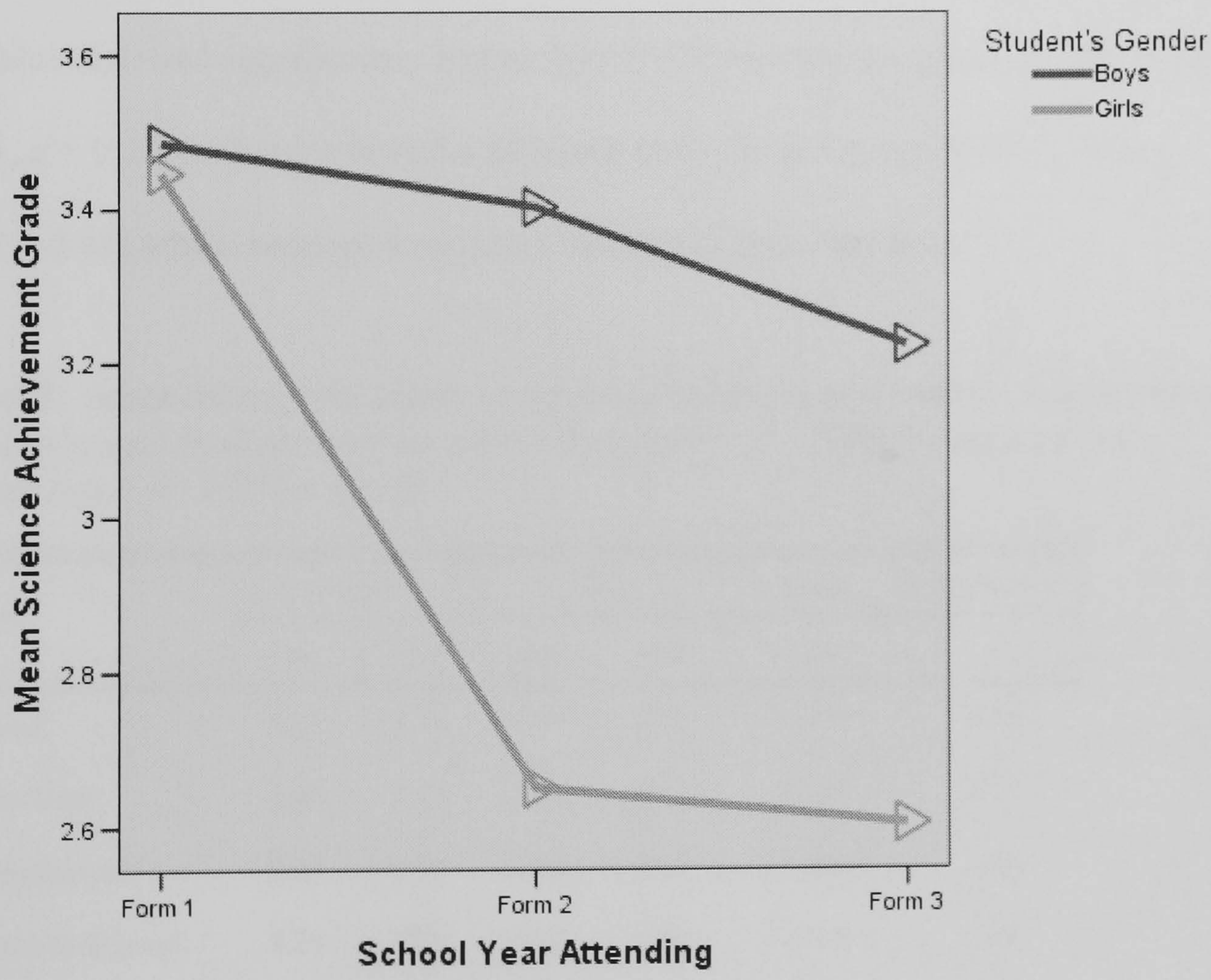

Figure 5.9. Science achievement by gender and year level

Comparing Gender Differences on Motivational Measures

An independent-samples *t* test was conducted to evaluate the hypothesis that females would display more learned helplessness than males. Table 5.15 shows an independent *t*-test table comparing mean scores, standard deviations and effect sizes on motivational measures by gender. The results were consistent with Research Hypothesis (6) and indicated that females demonstrated lower motivation than males in the Science domain. Females demonstrated significantly higher mean scores compared to males on learned helplessness, $t(998) = -3.22$, $p = 0.001$, $d = -0.20$. Furthermore, males displayed significantly higher mean scores than females on the positive motivational dimensions of learning goal, $t(973) = 3.39$, $p = 0.001$, $d = 0.22$, and self-efficacy beliefs, $t(985) = 4.93$, $p = 0.001$, $d = 0.31$, which is a medium effect size. Males also had significantly higher levels of performance goals, $t(998) = 2.02$, $p < 0.05$, $d = 0.13$, and more positive attitudes towards Science, $t(998) = 7.08$, $p < 0.001$, $d = 0.45$, which represents a larger than medium effect size.

Table 5.15. *Independent t-test table comparing mean scores, standard deviations and effect sizes on motivational measures by gender (N=1000 for all students; n=497 for boys; n=503 for girls)*

Dimension	Mean		SD		*t*-test	Effect Size
	Boy	Girl	Boy	Girl	*t*-value	*d*
Learning Goal	4.23	4.05	0.92	0.79	3.39**	0.22
Performance Goal	3.86	3.73	1.04	0.97	2.02*	0.13
Learned Helplessness	2.29	2.50	1.03	0.98	-3.22**	-0.20
Attitude towards Science	4.24	3.83	0.92	0.89	7.08***	0.45
Self-efficacy Beliefs	4.17	3.95	0.75	0.68	4.93***	0.31

*** Significance at the 0.001 level. ** Significance at the 0.01 level. * Significance at the 0.05 level.

Summary

The results were consistent with Research Hypothesis (5) and (6). Females in this study displayed a significantly lower Science achievement outcome than males between Form 1 and Form 2, and between Form 1 and Form 3, and lower motivation in Science than males. Females in the higher junior secondary year levels demonstrated stronger learned helplessness than males in Science while males showed significantly higher levels of positive motivation in terms of learning goals and self-efficacy beliefs, more positive attitudes towards Science, and higher performance goals.

CHAPTER SIX

DISCUSSION AND CONCLUSION

Introduction

Hong Kong has thousands of students dropping out of secondary education every year. In recent years, between 2004 and 2006, approximately two out of three junior secondary students continued their secondary education beyond Form 3, and only one out of seven students progressed from primary to the end of senior secondary education in Hong Kong (EDB, 2006a). During the mandatory nine years of education, students in Hong Kong aged from six to fifteen have to go through three selection assessment allocation systems. These systems choose those students, who have ability according to their academic performance, to receive continuous subsidised education from the government and to compete for the acceptance by Band One schools. After three assessment allocations, students have to take two public examinations, HKCEE and HKALE, to be considered for entrance to a local university. Only a small fraction of students are able to pass through all of these obstacles and obtain a 'seat' in a subsidised university in Hong Kong. Tang and Biggs (1996) argue that the primary function of the education system in Hong Kong appears to be to select the top 5% or so of students for subsidised tertiary education rather than to educate the majority of students. This pyramidal education system might serve as a means of selection process for higher education and career opportunities. Under this competitive education system, students may feel tremendous pressure to be one of the fittest for academic achievement in Hong Kong. There is a serious concern about young students who are confronted with academic failure by losing their subsidised school "seats". This early academic failure may

ruin these adolescents for the rest of their schooling. The traditional competitive norm-referenced education system may put students at risk of developing motivational and behavioural problems.

In addition, competition in Hong Kong's labour force has increased during the economic downturn in recent years. The functional value of education has increased as many are concerned about losing or getting jobs. Attaining a higher level of education becomes extremely important because employment opportunities are based on education level. If youngsters have the desire to succeed in the future, they have to achieve high levels of education. Moreover, owing to the advances of science and technology in the past two decades, science has become a valuable academic subject for young people to obtain better employment opportunities and to be more competitive in the fast growing high technology industries in Hong Kong. The global significance of science education has been escalating.

Furthermore, a number of studies have shown that motivation in junior secondary school students declines after transferring from elementary schools in the western regions, particularly in the United States (e.g., Anderman & Maher, 1994; Anderman, Maher, & Midgley, 1999; Nicholls, 1979). As motivation can influence academic and career choices (Lent *et al.*, 2001; Navarro *et al.*, 2007), motivational decline may cause serious concerns. The results of motivational decline might lead to a potentially disturbing development in students' futures and might cause long-term effects throughout life (Eccles *et al.*, 1993b).

On the basis of prior research and a review of the background behind Hong Kong education, the growing importance of science education, and evidence of motivational decline in the junior secondary students in Western societies, the intention of this study was to examine the relationship between motivation and

achievement in Science of junior secondary Chinese students in Hong Kong. This chapter discusses the results reported earlier. It summarises the major motivational predictors for Science achievement, and conversely, the predictive power of Science achievement upon motivation. The chapter relates these findings to key cultural issues in relation to motivation and achievement of Chinese students in Hong Kong, and concludes by examining the implications of these findings for education policy and practice. Finally, the limitations of the study and more general conclusion are presented.

Discussion of Results

The most interesting yet, to some extent, surprising finding of the study was that the results were largely consistent with these five major theories found in the western literature. The results supported the study's six hypotheses and demonstrated that the junior secondary Chinese students in Hong Kong showed similar motivational patterns to many western students, particularly in the United States (e.g., Anderman & Maher, 1994; Anderman, Maher, & Midgley, 1999; Nicholls, 1979). The predictive information obtained here about the antecedents of these motivational constructs may provide educators in Hong Kong with greater understandings and can be used to support and facilitate student success throughout the secondary school years. These findings may help science educators to consider that Chinese junior secondary students in Hong Kong might behave similarly (at least on those five constructs) to the students in the United States. These understandings can speed up the process in modelling theories and enhancing implementation and supporting work for science education in Hong Kong.

In Hong Kong, the motivation of older junior secondary students was lower than Form 1 students, in particular the Science domain, as seen from a cross-section of year levels. Different motivational patterns in Science were found in the junior secondary students in this study. Findings strongly indicated a coherent trend as predicted in Research Hypothesis (1) that there is a lower motivation among higher year levels of junior secondary students in Hong Kong by age. Two major patterns were identified between year level and motivation in this study: The higher the student year level, the stronger the negative motivation experienced (learned helplessness) and the lower the positive motivational influence experienced by students (self-efficacy, learning goal and attitude towards Science). Form 3 students showed greater extents of learned helplessness, and lower degrees of self-efficacy beliefs, learning goals and attitudes towards Science than Form 1 students (see Table 5.1). Furthermore, this study identified several differences in science motivation between the students from local schools and international schools. The Chinese students from international schools reported stronger self-efficacy, higher performance goal and a more positive attitude towards Science than the local school students; at the same time, the international school students demonstrated lower degrees of learned helplessness (see Table 5.2). More importantly, these are significant predictors for Science achievement. These motivational patterns favouring Chinese students from international schools might be caused by various factors, including school-based factors and students' characteristics. School-based factors might consist of class size, curriculum, laboratory facilities, quality of teaching, school culture, school objectives or others. Students' characteristics may include parents' education and occupation, family support and living environment. The parents might receive their education from other countries or often travel to

different countries for work or leisure. The influence from other cultures might affect how much they follow traditional Chinese values. More details on cultural influence are discussed in the next section (Cultural Dilemma). Since international schools in Hong Kong have smaller class size than the local schools, international school students have more opportunities to work in pairs instead of in groups of four or five students in the science laboratories. Furthermore, international schools emphasise hands-on experiences in Science. Hence, they frequently provide opportunities to undertake experimental investigations and organise field trips for students to explore nature. These activities can promote students' positive attitudes towards Science. Furthermore, these students may experience less pressure placed upon them from their family or school because they usually continue their tertiary education outside Hong Kong, where an abundance of university places exist. However, more research is required to identify the factors that lead to these motivational patterns.

As predicted in Research Hypothesis (2), the older junior secondary students demonstrated lower science motivation than their younger peers. Consistent with a number of studies (e.g., Breakwell & Beardsell, 1992; Doherty and Dawe 1988; Hadden & Johnstone 1983; Johnson 1987; Simpson & Oliver 1985; Yager & Penick 1986) on the transition from the point of entry to secondary school, the younger junior secondary students aged from 11 to 13 demonstrated significantly higher science self-efficacy beliefs than the older students aged 14 and 15 (see Figure 5.3). Likewise, the younger students aged 12 exhibited significantly more positive attitude towards Science than the older junior secondary students aged 15 (see Figure 5.1). The current results demonstrated lower science motivation among the older junior secondary students (see Table 5.3). However, further research (e.g., time-series

longitudinal studies) needs to be undertaken to show a clear indication that a motivational decline was occurring.

As hypothesised in Research Hypothesis (3), this study found a negative correlation between year level and Science achievement (see Figure 5.4). The Form 1 students had higher Science achievement grades than Form 2 and Form 3 students regardless of which type of school they were in. Moreover, being in the international schools, students received higher Science achievement grades than the other two types of school (see Figure 5.5). Students in the DSS schools received the lowest grades regardless of what year level. These results suggest that the older students might experience more obstacles or more pressure with higher academic demands in Science than the younger ones, particularly in the local schools; and thus, it is expected they demonstrated stronger negative motivation when facing academic challenges.

Coherent to Research Hypothesis (4), two principal patterns of relationships between motivation and achievement in Science were identified in this present study: an inverse correlation between Science achievement and a negative motivation, and a positive correlation between Science achievement and a number of aspects underlying positive motivation. The poorer the Science achievement, the higher were the degrees of learned helplessness. On the other hand, the better the Science achievement, the higher were the degrees of science self-efficacy, learning goals, performance goals and attitudes towards Science. The predictive power of Science achievement was also assessed in this study. The results indicated that higher Science achievement significantly predicted higher degrees of self-efficacy. learning goals, performance goals and attitudes towards Science; and poor Science achievement was a significant predictor of learned helplessness.

In this study, the junior secondary school students who failed Science with an 'F' attainment grade showed significant differences from the students who obtained 'A', 'B' 'C', 'D' and 'E' grades on the dimensions of level of learning goal, learned helplessness, attitude towards Science and self-efficacy, and from the students who received 'A' grade on the performance goal orientation. The underachievers who failed Science demonstrated significantly greater degrees of learned helplessness (see Figure 5.6). Learned helplessness was found an inverse medium association with Science achievement, and as a significant negative motivational predictor of Science achievement in this study. By the same token, students with high degrees of learned helplessness tended to have lower Science achievement grades. Learned helplessness is characterised by challenge avoidance and low persistence when facing obstacles. Repeated failures are typically followed by deteriorating performance on subsequent tasks when students may believe that effort is useless and thus quit trying (Abramson *et al.*, 1989). They might view themselves inadequate in controlling their achievement outcomes or overcoming adverse circumstances. When these underachievers face chronic academic failures, there is a higher possibility that they will develop learned helplessness. At the same time, these underachievers also demonstrated significantly lower mean scores on science self-efficacy, learning goal, performance goal and attitude towards Science dimensions (see Figure 5.7 and 5.8).

Research (e.g., Multon, Brown, & Lent, 1991; Pajares, Britner, & Valiante, 2000; Schunk & Pajares, 2002) found that students with higher sense of self-efficacy accomplish higher performance levels. This study shows coherent findings with prior research: self-efficacy was strongly and positively associated with Science achievement in the junior secondary school students. Furthermore, these

relationships were consistent with the position of Bandura (1986; 1997) that self-efficacy belief is a strong predictor of academic achievement. The results in this study indicated that self-efficacy was the most prominent among all motivational factors (see Table 5.12) contributing to Science achievement.

Parallel to educational studies on attitude towards science (Beaton *et al.,* 1996; Osborne and Collins, 2000; Simpson and Oliver, 1990; Weinburgh, 1995), this study found that students who performed better in school tended to have more positive attitude towards Science than those who do not do well in school. Other results in this study indicated that positive attitudes towards Science are associated with better Science achievement grade (see Figure 5.8). Attitude towards Science was an important significant predictor for Science achievement in this study. Since self-efficacy and attitude towards Science are important positive predicators of Science achievement, students with high levels of science self-efficacy along with positive attitude towards Science are more likely to perform well in Science in the junior secondary schools.

Consistent with many previous findings (e.g., Middleton *et al.*, 1998; Urdan, 1997), holding learning goals were positively and strongly associated with self-efficacy beliefs, and also moderately associated with Science achievement in this study. Holding learning goals were found significant when individually predicted Science achievement although it was found not significant with the linear regression in combining with the other four motivational variables.

The results in this study supported the findings in Pajares, Britner and Valiante (2000) that performance goals were positively and significantly correlated with achievement. Although performance goal was only a minor predictor in this study, it was a statistically significant predictor of Science achievement. Pajares,

Britner and Valiante (2000) suggest that performance-approach goals might serve a facilitative function in enhancing motivation. This higher performance goal orientation may facilitate students' motivation in Science. Although there are only few studies on the predictive values of achievement goal orientations for achievement, this study found that achievement goal orientations were significant predictors for Science achievement.

Similar to the findings of TIMSS studies by Beaton *et al*. (1996) and by Martin *et al*. (2004), this study found that males outperformed females in Science achievement in the junior secondary Chinese students in Hong Kong. The results were consistent with Research Hypothesis (5). Although both genders started with the same Science achievement level in Form 1, females in the higher junior secondary year levels experienced significantly lower Science achievement than males (see Figure 5.9). As the Science curriculum increase in difficulty in higher year levels, students experience more challenges or demands. However, males still performed significantly better than females in Science. There might be a wide range of factors, such as learning styles, mathematics ability, males' exposure to more science-related activities when they are outside the classroom, and cultural influence in favouring males in the science subject. However, further research is needed to better understand the reasons.

Parallel to Research Hypothesis (6), there was a salient gender difference in motivation in the Science domain. The findings in this study suggest a correlation with the findings of Catsambis (1995) and Eccles *et al*. (1993b): females, in particular, experienced lower science motivation than males in Hong Kong's junior secondary schools. Females demonstrated significantly lower science self-efficacy perceptions, lower levels of learning goals, performance goals and attitudes towards

Science than males. Females who exhibited a significantly higher level of learned helplessness than males. The lower motivation in junior secondary females should raise concerns to Hong Kong's science education. These young girls might stop taking science courses after finishing junior secondary schools, and it potentially excludes a wide range of career interests before they are wise enough to choose.

Cultural Dilemma

This section presents an attempt to analyse the influence of cultural background on Hong Kong Chinese students' achievement motivation. Stevenson (1999) stresses, "one can not hope to learn how educational systems can be improved or academic achievement can be increased without understanding the actions, beliefs and attitudes related to education that exists within the culture" (p. 119). Culture is an important factor in influencing educational systems and academic achievement. Under the predominant Confucian heritage, Chinese culture has traditionally highly valued academic excellence (Giles, 1972; Ho, 1986; Wu, 1989; Yang 1986). The Chinese believe their future prosperity and social status depends on the academic success of the children in their family. Parents generally have extremely high expectations of the children, and commonly use strict disciplinary tactics on their children to make them spend almost all of their time doing school-related work (Ho, 1981). With the shortage of university places and the cultural pressure to succeed academically, Hong Kong's education system has evolved into a competitive environment with an unrealistically demanding curriculum. Only a relatively small number of students can survive in this competitive education system. While students' motivational levels might increase to be one of the achievers. this

competitive education system might also lead to mental health issues and a lack of social life and emotional development.

Unlike many western cultures, Chinese cultural values place a relatively strong emphasis on effort and hard work over ability in education. The Chinese believe that people can achieve almost anything if such values are applied in life (Salili, 1995). Chinese students in Hong Kong put more emphasis on effort, interest, mood, or study skills than ability as an achievement cause (Hau & Salili, 1989, 1991; Salili, Hwang & Choi, 1989). This view is reflected by many proverbs as previously mentioned in chapter one, and here is another example of favourite quotation of Chinese children, "Genius comes from diligence and knowledge depends on accumulation" (Lin & Leonard, 1998). The role of effort over the role of ability is stressed by this motto. Children with lower abilities are told they can share success with other children if they work harder. These children are inspired by the Chinese proverb, "The slow bird needs to start out early." The rate at which one obtains knowledge is determined by abilities. However, effort determines the ultimate level of achievement. In the West, although hard work and effort are praised, having success or being seen as a winner is more significant (Spence, 1985), and effort is treated more being in the service of an individual's egotistic interest (Salili, 1995). Ability is considered to be a more controllable element strengthened by high effort in the Chinese culture (Salili & Hau, 1994). Students are more likely to work harder if they attribute success or failure to effort than to ability (Weiner, 1986). If failures are attributed to low effort, failing Chinese students may decide to put more effort in the future to increase their ability. However, in the West, ability is an important factor for success that is perceived as less controllable and relatively stable (Weiner, 1992a). The problem with having a perception of ability as being stable is that when

failure occurs, the attribution of lack of ability will not result in an improved approach, but instead lead to learned helplessness. Hence, the Chinese students' traditional attributional approach may represent a more adaptive approach to lessen learned helplessness behaviour (Salili, 1996). However, this precious traditional approach might be at risk in Hong Kong (at least in junior secondary students) today. The students in this study demonstrated very similar motivational patterns (at least on those five examined constructs) to students in the United States. Although the Chinese culture emphasises on the role of effort in raising academic performance, the extent to which the Hong Kong Chinese students adhere to this culture may vary. It depends on whether the students live in a traditional Chinese environment or in a family that places less emphasis on effort.

The reasons for similarities in motivational patterns between Hong Kong and American students might be due to the influence from westernisation of education, modernisation of the society, or others. Globalisation also has a strong cultural influence on people in the world, including Hong Kong. When products and services are produced and distributed throughout the world, goods, capital, technology and labour integrate with each other worldwide. For example, American cars are a globalised product. They are produced and distributed in many large cities around the world. These American car corporations have to hire and train local workers to help build their cars and provide after-sales services. The local trainees will learn American business concepts and culture. Those workers will, in turn, bring some of the American culture home and influence their family members. The people in Hong Kong might also be influenced by the American culture when they watch their advertisements on TV or posters. It will expose the Hong Kong people to the American culture; however, the degrees of adaptation of Chinese people to the

American culture may vary. Globalisation has an important impact on influencing Chinese people in Hong Kong to become more westernised. Furthermore, Hong Kong has been undergoing rapid industrialisation and now has changed to focus on knowledge-based economy, e.g., financial and technological driven economy. The younger generations have higher levels of education, income and occupational status than older generations; and thus, may raise their children differently from their forefathers. The Chinese character in Hong Kong is shifting in the direction of a more individualist and less collectivist orientation. However, it requires more research effort to investigate the casual relationships between cultural influence and motivation.

The association between academic self-efficacy and achievement might be cultural specific. Having very high levels of academic self-efficacy might not help all students to demonstrate high academic performance. In the international analysis of TIMSS 2003 data, Martin *et al*. (2004) reported that four Asian Pacific countries – Hong Kong SAR, Chinese Taipei, Korea and Japan – showed very high international averages in science achievement, but the lowest self-perceptions of their ability to learn science. The results suggest that these countries might share cultural beliefs that encourage the expression of modest self-perceptions (Martin *et al*., 2004). On the other hand, those countries with poor science achievement – Tunisia, Ghana and Egypt – reported very high self-perceptions in respect of learning science. These results are parallel to the findings of Shen and Pedulla (2000) who conclude that academic performance was positively correlated with academic self-perceptions within a country while the relationship was negative when between country analyses were conducted. These findings suggest that excessively positive self-evaluations from poorer performing countries may be influenced by lower educational standards

and expectations (Elliott *et al*., 2005). In this study, although the students from international schools displayed higher self-perceptions and Science achievement grades in their report cards than the local school students, it is difficult to determine if they had received lower expectations and standards from their schools and led them to believe that they performed better than they actually were because this study did not include a standardised test to compare students' achievement from different types of schools.

Artificially higher achievement grades with lower expectations and standards might lead students to be less motivated to set higher goals to improve performance (Shen & Padulla, 2000). They might perceive that they are already doing well and science is easy, and it is not necessary to put forth more effort to study science. Elliott *et al*. (2005) argued, "… widespread overestimation of student abilities and performance running throughout a culture could result in student attitudes, teachers and parental expectations, and educational practices that militate against the highest levels of achievement" (p. 92). Reaching an appropriate level of academic self-efficacy to match a school's, district's or nation's curriculum standards and expectations for students to achieve the highest academic performance could be a cultural specific dilemma. Therefore, it is worthwhile for teachers, educators and policy makers from different types of schools to learn from each other. It provides the opportunities to determine what curriculum, standards, instruction, or other factors might work in one type of school can be adapted to other types of schools to help raise students' performance.

The Impact of Globalisation upon Education Reforms in relation to Student Achievement in Hong Kong

Globalisation has an impact not only on Chinese culture but also education reforms in Hong Kong. Education policies in Hong Kong have been strongly influenced by globalisation. In the trend of developing knowledge-based economy around the world, education has put more emphasis on the market and practical value. With manpower being the major asset available in Hong Kong to support its social and economic developments in this rapid changing world economy, education has been placed as a critical means to ensure a skilled and high quality labour force. Under the influence of globalisation, Hong Kong's education has been skewed towards vocational and economic goals in human capital to strengthen its economic competitiveness. As a consequence, education reforms have adapted the most popular policy strategies of marketisation, privatisation and corporatisation (Mok & Currie, 2002). Schools under the new trend of education policies in Hong Kong, particular the Direct Subsidy Scheme (DSS) and international schools, have experienced a paradigm shift leading them to be more market-like based on the rules of selection and competition. These school organisations are more business-like to develop effective management, and have to be more competitive, efficient, flexible, and diversified in this new environment. When schools are required to be more responsive to the community and parents through marketisation, they become more accountable to the public. These two types of schools put high importance upon parental preference because parents are their customers who spend a large amount of money on their children's school fees. It is especially true in the case of private international schools, which do not receive any recurrent subsidies from the government. In other words, parents are their sole source of income to keep the

school running. Most of these schools publish their outstanding student achievement results to the public, hoping that more parents and students will select their schools. Therefore, the education performance of these schools is monitored and audited by the marketplace. Student achievement and school performance are their top priorities.

Furthermore, globalisation has an important impact on restructuring government and aided schools in Hong Kong. These schools have experienced major educational policy reforms since the early 1990's. The policymakers in Hong Kong cloned the educational system blueprints from western countries, particularly England and Wales, Australia and the USA, as the basic structure of the school management reforms (Dimmock, 1998). In 2000, the Education Department commanded all public-funded schools, including government and aided schools, to begin implementing school-based management (SBM) in Hong Kong. Under this new management structure, the public-funded schools would receive greater flexibility and autonomy in finance, personnel, curriculum and student admittance; however, they are obligated to be more responsive to the community and parents, and more accountable to the government through auditing procedures. These reforms restructured the school system in the aspects of administration and management with the purpose of improving the quality of schools. The assumptions of this western-borne school-based management are that the participatory decision making of teachers, parents and students would help schools pursue better academic domain of education, and help meet the needs of students to improve student learning and performance. Hence, these public-funded schools are more accountable to the public on their students' achievement.

Implications of the Study

Nine years of compulsory education means that some students might not have any more education after they finish Form 3. Students who cannot cope with the pressure of numerous examinations and poor family support are forced to quit education and start getting jobs when they turn fifteen years old. However, with the high youth unemployment rate in Hong Kong, even the Form 5 graduates often have difficulties in getting employment. Those Form 3 drop outs might subsequently show social problems, including juvenile delinquency and drug abuse. To minimise such problems, enhancing the motivation of junior secondary students is a critical issue for those policymakers and educators who plan and implement educational programmes for secondary schools. The development of enrichment programmes and training curricula responding to the performance and attainment of adolescents in Hong Kong junior secondary schools could be facilitated by a greater understanding of how motivation affects adolescents. The findings in this study may help science educators in undertaking further research on how to facilitate Hong Kong students' motives to perform well, particularly in Science.

Promoting Self-efficacy in School Practices

Given the practical linkage of educational accomplishment to the future success of Hong Kong, school achievement, effectiveness, and productivity are major issues in attaining a competitive edge in the global economy (DeConcini, 1988). What can education leaders do to create and maintain high achieving schools in Hong Kong? Educational research has identified that motivation in school is a crucial factor to student achievement (Maehr & Fyans, 1989). For example. self-efficacy beliefs are strong predictors of academic preference, career choices and

future motivation (e.g., Bandura, 1997; Blustein, 1989). Different studies (e.g., Maehr, 1987) have suggested that education leaders can develop an environment or school culture to foster positive motivation. Due to the potential impact of self-efficacy on the enhancement of student motivation and achievement, school practices should reflect an emphasis upon developing self-efficacy beliefs. Students may avoid selecting the classes in which they feel they lack the competence to compete and choose classes in the subjects in which they feel the most competent. When students perform well on science tests and earn high marks in science classes, they develop a strong sense of efficacy in their science competence which will help ensure students to enrol in subsequent science related courses, increase their effort in the face of difficulty, and approach science tasks with persistence. There are several ways that science educators and teachers might consider developing students' self-efficacy. The following is a list of suggestions:

- *Encourage learning achievement goal orientation*

  The results in this study have shown strong positive correlations between learning achievement goal and self-efficacy in the junior secondary Chinese students. When school practices emphasise mastery, self-efficacy motives become salient. Research has found that students with a learning goal orientation are more likely to demonstrate greater self-efficacy and higher persistence in the face of difficultly, emphasise task mastering rather than showing themselves to be better than others, attribute their success to effort instead of ability or luck, and seek challenges. More importantly, when learning goal oriented students encounter failure like everyone does sometimes.

they demonstrate higher persistence (Bandura & Schunk, 1981; Elliott & Dweck, 1988).

- *Create activities for self-efficacy beliefs to generalise*

Bandura (1997, p. 50) states, "The development and exercise of capabilities would be severely constricted if there was absolutely no transfer of efficacy beliefs across activities or settings." Self-efficacy beliefs can generalise strongly across situations or activities (Bandura *et al.*, 1980). New experiences can be influenced by the beliefs attained during a set of experiences. When facing new tasks requiring similar skills, students tend to believe that the results will be similar to those from the previous task. These beliefs will generalise to new tasks (Bandura *et al.*, 1980). Few activities are totally new. Many involve different mixtures of familiar and new tasks. People who concentrate on the familiar features of new tasks might demonstrate better transfer of perceived self-efficacy than those who focus on the new aspects (Cervone, 1989). Students have a higher tendency to generalise perceived efficacy in more similar activities. Hence, for example, if students find that academic progress and greater understanding in Science can be obtained by an increase of perseverance and effort, they may transfer such beliefs to achieve success in other similar academic subjects, such as Mathematics.

Influential performance accomplishments create "transforming experiences" which can strengthen students' beliefs in various parts of their life (Bandura, 1997). Students' lives may be changed by the experiences they encounter, such as trying out for the school's

debating team, and finding that they enjoy and excel at this. Their success in debating might raise perceived self-efficacy and transform the experience into other parts of their lives. These opportunities make the generalisation of self-efficacy beliefs to be stronger and wider.

- *Extends the collective efficacy of the school*

Collective efficacy refers to a situation where a group of people, such as students, teachers, parents, school administrators and educators, share beliefs in their capabilities to achieve goals and tasks (Bandura, 1997). A school can cultivate collective beliefs as a group about its students' capabilities to achieve and teachers' ability to enhance students' performance. The competence of administrators and policymakers can build up environments contributing to these. Bandura (1993) suggests that collective efficacy has mediated the influence of previous academic attainment, socioeconomic status and teachers' longevity on students' academic achievement in different middle schools. The teachers' sense of personal teaching efficacy is related to a school's collective efficacy and their satisfaction with school administrators. The collective efficacy of a school can influence teachers' and students' sense of efficacy.

- *Customise lessons to student abilities*

Competition and social comparison in classrooms can cause a decrease of self-efficacy among students who view themselves as lacking in ability and others as being more capable. However, social comparisons can be reduced when classroom environments are individualised and instructions are adapted to students' academic

capabilities (Gardner, 2006). Students can measure their academic progress using their own standards to minimise comparison of their personal development in relation to the progress of their classmates. Self-efficacy is more likely to increase in individualised learning environment because it lowers the competitive orientation of a classroom. The practices of ability grouping, rigid instructional sequences and standardised assessments often used in a highly competitive school might change self-efficacy into self-doubt (Pajares. 2006). On the contrary, Meece *et al*. (2003) found that when teachers practised student-centred instructions that encouraged individual developmental needs, supportive relations and student voices to be valued, middle and high school students reported higher self-efficacy.

- *Put more emphasis on effort than ability on performance feedback*

Teachers should promote a belief that effort can overcome difficulties, and ability can be changed and controlled. When students are commended for effort on their performance, they are told that they can improve and accomplish more by working harder. On the other hand, when teachers praise students for ability by using the terms 'smart' or 'clever', students might believe that ability determines success. If these students believe that they do not have ability, such an orientation can make them lose more confidence in their ability because they believe that it is beyond their control. Dweck (1986) suggests that when students are mastery-oriented with high confidence in their ability and believe that intelligence is malleable, their performance can be facilitated by increased challenges. Thus, teachers

and schools should put emphasis on effort and persistence rather than ability when providing feedback on student performance.

Foster Positive Attitude towards Science

Many studies have documented that a decline in students' interests and attitudes towards science occurs from the point of entry to secondary school (e.g., Breakwell and Beardsell 1992; Doherty and Dawe 1988; Hadden & Johnstone 1983; Johnson 1987; Simpson & Oliver 1985; Yager & Penick 1986). Since science education and scientific careers can only be pursued by students who take science, the number of science-based students eligible for higher education is an important factor for Hong Kong's economic future. The standards of competitiveness and achievement of a country are based on a well trained, highly educated and adaptable workforce. There is a major concern that a serious threat to economic prosperity will occur if there are negative attitudes towards science, which in turn are likely to cause a low uptake of science. Hence, it is important to raise students' interests in liking science. Fostering positive attitudes can become an important educational objective.

Although student attitudes towards science are influenced by many factors, research points to the critical significance of the quality of teaching. In a ten year multi-dimensional and longitudinal investigation using extensive data from the National Science Foundation, Simpson and Oliver (1990) concluded that the strongest influence on attitudes towards science comes from school, particularly classroom variables. Studies (e.g., Ebenezer & Zoller, 1993; Haladayana *et al.*, 1982) found that quality of science teaching students experienced was the most significant determinant affecting students' attitude towards science. Woolnough (1994) confirmed this finding and reported that the kind of science teaching was also a key

factor in affecting students' subject choices to continue science education after turning 16 years old. To improve the quality of science teaching, Osborne and Collins (2000) suggest that practical work in science, extended science investigations, and opportunities for discussion are desired by students. These desires can create an enhanced function for personal learning autonomy (Osborne & Collins, 2000), which in turn increases engagement (Wallace, 1996). In short, teachers have a crucial role in fostering positive student attitude towards science. The results in this study have shed light upon the above findings. The students from international schools, in which teachers might put more emphasis on the above practices, showed a more positive attitude towards Science than the students from local schools. However, more research effort is needed to examine the factors that determine their attitude towards Science.

Motivation Retraining Programmes

Another critical implication derived from the findings of this study at the policy level is that effective culture-specific and gender-specific prevention and intervention programmes should be established and designed to meet gender differences in academic needs. The major functions of the programmes are to provide intervention to improve the performance and persistence of those local Chinese students with strong negative motivational influences, and to implement prevention training to facilitate student achievement. Various retraining programmes have been conducted to change the attribution of failure from lack of ability to insufficient effort (e.g., Craske, 1988; Föersterling, 1985; 1988) in developed western countries. Attribution retraining programmes are built on the foundation that increased emphasis on effort mediates better performance. The training helps the

underachievers to understand that their failures come from insufficient application of effort (Anderson, 1983). When retraining children's attributions for failure. children learn to attribute failures to strategy or effort instead of ability. The changes in persistence generalise across tasks and persist over time (Dweck, 1975; Fowler & Peterson, 1981). However, this training only applies to the students who believe that they lack ability to succeed academically, rather than those who have other problems, such as lack of organisation or study skills.

Training may also enhance students' self-efficacy and lead to better performance. According to Bandura (1986), self-efficacy refers to the way a person views their own ability to accomplish certain performance levels. It does not relate to the skills of the people, but on how much they believe that they can apply their skills to reach specific goals and perform well. As a student comes to believe that their errors have happened because they have not worked hard enough, and that they can perform better by working harder, doubts about any lack of fixed abilities will decline. Feelings of self-efficacy and hope for potential success will increase. Improvement in self-efficacy beliefs and expectations for future success are critical factors in obtaining better performance (Bandura, 1981; Schunk, 1983; 1984b). These programmes may help students to lessen the debilitating effects of failure and learned helplessness pattern after training (e.g., Au, 1995; Dweck, 1975; Fowler & Peterson, 1981) in their early stage of life.

Limitations of the Study

There are several limitations in this study. First, the data collected is cross-sectional instead of time-series longitudinal. A longitudinal analysis approach would provide valuable information about developmental changes, and may be useful for establishing causal relationships (Cohen *et al.*, 2000). This cross-sectional study does not permit the analysis of causal relationships between motivation and achievement. Further research effort would be required to consider the causality of their relationships.

Second, the small sample size is a major limitation of this study. According to the statistics from EDB, Hong Kong has a total of 519 secondary schools including 496 local, and 23 international schools with a total number of 253,619 junior secondary student populations in the 2004/05 academic year (EDB, 2006a). This study includes only 1,000 students from five local schools and two private international schools in Hong Kong. The sample size (N = 1,000) is constrained because only seven schools were used in this experimental project. If this study were extended to more schools in Hong Kong, the reliability and external validity of this study would be increased.

Third, this study examined the relationship between students' performance and year levels in junior secondary schools. A potential weakness of this study is that it employed self-report achievement data rather than standardised test results in assessing students' performance in Science. Utilising some form of standardised assessment may have provided a more reliable and valid measure of student achievement that would have rendered comparisons between schools more meaningful.

Finally, students' self-report measures were the only source of data available for analysis. Different data-collecting instruments (e.g., observation, interview and documentation) could be used to demonstrate high correlations among different instruments to increase the concurrent validity of this study. For example, students might be observed when they are in Science classes, researchers might talk to students about their science motivation, or ask students to write down their achievement motivation. If the results from different approaches were all consistent, according to given motivational variables, there would be greater concurrent validity.

Conclusion

The findings of my study strongly indicated that the older junior secondary Chinese students in Hong Kong, particularly females, demonstrated lower science motivation. Since the junior secondary school years have a critical developmental impact on the motivation of adolescents, it is necessary to examine the literature to identify ways in which this problem might be tackled. This dissertation has offered some suggestions for educators, policymakers and researchers to develop various strategies and programmes to enhance student motivation for academic success. Culture-specific and gender-specific motivation retraining programmes may help to raise positive motivation and expectations for future success, and lessen the learned helplessness motivational patterns of underachievers.

I hope that the findings of this study together with those from related studies, some of which are reported here, will encourage other researchers to investigate motivational factors and determinants of academic achievement, and that findings from such studies will help to inform future educational efforts to facilitate academic success.

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Appendix I

JUNIOR SECONDARY EDUCATION ASSESSMENT SYSTEM

- Under the existing policy, all Secondary Three (S3) students in publicly-funded schools who have the ability and wish to continue their study will be provided with subsidized Secondary Four (S4) places or training places.

- The Junior Secondary Education Assessment (JSEA) System is a system of allocation of subsidized S4 places or Post Secondary Three (PS3) craft course places to S3 leavers.

Admission to S4 or PS3 Craft Courses

- **Admission to S4**

  - S3 students are promoted as far as possible to S4 in their own schools according to their academic performance.

  - Students who cannot gain promotion to S4 in their own schools will have to participate in the Central Allocation for subsidized S4 places or PS3 craft course places.

  - Senior Secondary (SS) schools under the Direct Subsidy Scheme will recruit S4 students on their own before end of May 2005. S3 students may apply to the SS schools direct for admission. Besides, S3 students may also apply for the remaining S4 places of SS schools through the Central Allocation mechanism under the JSEA System.

- **Admission to PS3 craft courses**

  - Students may also apply for the full-time PS3 craft courses offered by the Vocational Training Council (VTC), Construction Industry Training Authority (CoITA) and Clothing Industry Training Authority (CIITA) through interview or the Central Allocation mechanism. Students who wish to apply for these courses through interviews should complete an application form and return it through their school to the Education and Manpower Bureau (EMB) for processing around April 2005.

- Students who have been admitted to any of the SS schools or PS3 craft courses will not be allocated other subsidized S4 places or craft course places.

THE SECONDARY FOUR PLACES ALLOCATION METHOD

- To enhance impartiality and to ensure that each subsidized S4 class is filled to the maximum permitted capacity, the allocation of subsidized S4 places is carried out on a territory-wide basis.

- Under the Secondary Four Places Allocation Method, EMB will base on the Eligibility Rate (ER) and Eligibility Quota (EQ) of individual schools to determine the priority of S3 students for allocation of subsidized S4 places.

- EMB will inform schools of their ER and EQ in April and June 2005 respectively. The calculation of ER takes into account the academic performance of the current S3 students, the total number of S4 places available and the ER of each school in the previous year. The calculation of EQ is based on the ER of each school, the number of S3 students as at entry, the number of dropouts, the number of students offered PS3 craft courses and those admitted to Direct Subsidy Scheme schools.

- The calculation of ER and the priority of S3 students to be allocated subsidized S4 places depend largely on the S3 students' performance in the school internal assessment. In this connection, participating schools are annually required to submit to EMB those students' half-yearly and yearly order of merit.

- For schools with sufficient S4 places to accommodate their own S3 students, all their students within the EQ will be promoted to S4 in their own schools. The rest of the students will have to participate in the Central Allocation.

- For schools with insufficient S4 places to accommodate their own S3 students, the students of the highest order of merit within the EQ will be selected to fill the S4 places of their own schools. The rest of the students will have to participate in the Central Allocation.

- In the case of participating schools without S4 classes, all students will participate in the Central Allocation.

CENTRAL ALLOCATION

- In June 2005, EMB will distribute to each student participating in the Central Allocation a Parents' Guidebook for Choice of Schools and a Secondary Four / Craft Courses Choice Form. Parents can make their choices of schools, school districts and PS3 craft courses in order of preference in the Choice Form.

- S4 and PS3 craft course places are allocated to all participating students through a computerized procedure, based on parental choice and order of merit scaled by the Secondary School Places Allocation Standard Scores.

ANNOUNCEMENT OF RESULTS

- Allocation results will be released in August 2005. Students allocated subsidized S4 places in schools other than their own or PS3 craft courses will each be given a Registration Form. These students should report to the school/institute/training centre to which they are allocated on the date specified.

- Registration forms will not be issued to students who have been offered S4 places in their own schools. Schools will register these students in the same way as those students admitted to other levels.

ENQUIRIES

Parents seeking further information should contact the School Places Allocation Section of EMB.

Address: 4th floor, Lui Kee Education Services Centre,
269 Queen's Road East,
Wan Chai, Hong Kong.

Telephone No.: 2832 7770

Education & Manpower Bureau's website: http://www.emb.gov.hk

Appendix II

Similarities and Differences among Aided, Direct Subsidy Scheme and Private Independent Schools

	Aided Schools	Schools under Direct Subsidy Scheme (DSS)	Private Independent Schools (PIS)
Description	Fully aided by Government and managed by non-profit-making sponsoring bodies under the Codes of Aid.	Receive Government financial assistance under the Direct Subsidy Scheme (DSS)	Non-profit-making (NPM) schools which do not receive any Government recurrent subsidies, except reimbursement of rates
Finance and School Facilities			
(a) School site/ buildings	Sponsoring bodies may apply for Government-built standard design school buildings leased under tenancy agreement of five year term (renewable on expiry subject to satisfactory evaluation of performance) for operating aided schools.	Sponsoring bodies may apply for Government-built standard design school buildings leased under tenancy agreement of ten-year term and renewable on expiry subject to satisfactory evaluation of performance.	Allocation of land by private treaty of ten-year term at nominal premium (renewable on expiry subject to satisfactory evaluation of performance) for the construction of the school building.
(b) Non-recurrent subsidies	Non-recurrent and capital grants as governed by the Codes of Aid.	Non-recurrent assistance in the form of a grant to carry out slope and major repairs exceeding $2 million. Capital grant for constructing the school since 1999 school allocation exercise.	Loan for slope repair Capital grant for constructing the school since 1999 school allocation exercise
(c) Recurrent subsidies	Recurrent grants as governed in the Codes of Aid.	Government subsidy is based on the average unit cost of an aided school place (X). A DSS school will continue to receive full recurrent subsidy from Government until its fee level reaches 2 1/3 of X. Beyond this level, Government will not provide any recurrent subsidy. If a school charges a fee between 2/3 of X and 2 1/3 of X, then for every additional dollar charged over and above 2/3 of X, the school should set aside 50 cents for scholarship/ financial assistance schemes.	Nil
(d) Upgrading	Subject to availability of funds, upgrading facilities are provided under the School Improvement Programme.	A one-off grant would be given to schools to upgrade their facilities to the latest prevailing standard of aided schools, subject to availability of funds.	At their own expenses
(e) School facilities	Aided schools are provided with standard school facilities and are given flexibility for acquiring school facilities with the resources provided. They may also acquire above-standard facilities at their own expenses.	Free to deploy resources or acquire school facilities of their choices at their own expenses.	Free to acquire school facilities of their choices at their own expenses
Teaching and Learning			
(a) Curriculum	Aided schools should develop a school-based curriculum on basis of the local curriculum prescribed by Education and Manpower Bureau (EMB).	Mainly follow local curriculum but free to design their own curriculum.	Free to design their own curriculum.
(b) Medium of Instruction (MOI)	Should follow the "Medium of Instruction Guidance for Secondary School" for selecting a suitable MOI.	Should choose a suitable MOI according to the ability of the students.	Choice of MOI is at the discretion of the schools
(c) Public examination	Mainly local examinations, e.g. HKCEE and HKALE.	Local and non-local examinations	Local and non-local examinations

	Aided Schools	Schools under Direct Subsidy Scheme (DSS)	Private Independent Schools (PIS)
Operation and Management			
(a) Administration and Governance	Administered in accordance with the Codes of Aid. Have to observe the conditions laid down in the service agreement signed with EMB.	Need to observe the conditions laid down for admission to the DSS scheme and in the service agreement signed with EMB. In connection with the renewal of the service agreement signed between DSS schools and the Government. DSS schools are allowed to engage outside experts to work with EMB in performance evaluation as long as certain conditions are met.	In addition to the Education Ordinance and Regulations. PIS have to observe the conditions laid down in the service agreement signed with EMB.
(b) Admission of Students	Except for a certain percentage of discretionary places, students of aided schools are allocated through the Primary One admission (POA) system at P1 level, the Secondary School Places Allocation (SSPA) system at S1 level and the Junior Secondary Education Assessment (JSEA) system at S4 level.	Schools have full discretion to admit students. Students of DSS secondary schools can continue their education in the same school beyond S3 level without having to participate in the JSEA.	Schools have full discretion to admit students
(c) Fee Remission	Fee remission is provided for the eligible students by the Government	Schools administer their own fee remission scholarship schemes	Schools administer their own fee remission scholarship schemes
(d) School Fee	Standard fees for S4-S7 only; small amount of Tong Fai and other collections are allowed on a pre-approved basis.	Schools can charge their students any approved school fees but government subsidy will be adjusted in accordance with a banding system.	Schools can charge their students any approved school fees.

	Aided Schools	Schools under Direct Subsidy Scheme (DSS)	Private Independent Schools (PIS)
(e) Appointment of Native English Speaking Teachers (NETs)	The appointment of NETs is governed by the Code of Aid and EMB's regulations on the NET Scheme	DSS schools have freedom in the appointment of NETs.	PIS have freedom in the appointment of NETs
(f) Salary and fringe benefits of teachers	The salary and MISS of aided school teachers are governed by the Code of Aid and relevant subsidy legislation.	The salary scale and fringe benefits of DSS schools need not follow those of aided schools.	Free to have their own salary scale and fringe benefits for their teachers.
(g) Provident fund arrangement	The provident fund arrangement for teachers of aided schools are governed by the Grant/ Subsidized Schools Provident Fund Rules. Non-teaching staff may participate in the non-statutory provident fund scheme.	DSS schools administer their own provident funds for their teaching and non-teaching staff. Teachers of an ex-grant/ex-subsidized school turning DSS can have the option of staying in the Grant Schools Provident Fund or the Subsidized Schools Provident Fund for a maximum period of five years as applicable.	PIS administer their own provident funds for the teaching and non-teaching staff.
Students			
(a) Class size	P1-P6: 32-37 S1-S5: 40 S6-S7: 30	P1-P6: 32-37 S1-S5: 40 S6-S7: 30	Free to determine the class size but within the limit as laid down in the Education Ordinance and Regulations
(b) Student Intake	Local children	Mainly local children	At least 70% of student intake must be local children.

Appendix III

General Directions

DO NOT WRITE YOUR NAME ON THE PAPERS.

The purpose of this questionnaire is to find out your view towards the subject of Science. There will be questions asking for your opinion, and about yourself. There are no "right" or "wrong" answers. Please read the questions carefully and answer the questions as accurately as possible. You may raise your hand for help.

For Section A, please read the statements in the questionnaire carefully and use a pencil to **circle** the appropriate number on the scale. "1" means you **strongly disagree** with the statement. "2" means you disagree with the statement. "3" means you somewhat disagree with the statement. "4" means you somewhat agree with the statement. "5" means you agree with the statement. "6" means you **strongly agree** with the statement.

For Section B, please **tick** the appropriate boxes.

Section A

Please read the following statements carefully and **circle** the appropriate number on the scale. "1" means you strongly disagree with the statement. "6" represents you strongly agree with the statement.

Question 1

How difficult is Science to me?

Item	Statement	Strongly Disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly Agree
1	I know I can fully develop the skills being taught in Science this year.	1	2	3	4	5	6
2	If I try, I can do even the most difficult work in Science.	1	2	3	4	5	6
3	If I don't give up, I can do most of the work in Science.	1	2	3	4	5	6
4	I can learn Science even if the work is hard.	1	2	3	4	5	6
5	I know I can find out how to do difficult work in Science.	1	2	3	4	5	6
6	Whenever I take Science tests or examinations, I become very nervous.	1	2	3	4	5	6
7	It is very difficult for me to concentrate on Science work.	1	2	3	4	5	6
8	Many Science topics are too difficult for me to handle.	1	2	3	4	5	6
9	I feel like I don't want to learn Science any more because I have too many difficulties.	1	2	3	4	5	6
10	It is difficult for me to effectively organise my study time for Science.	1	2	3	4	5	6

Question 2

Can I improve my experience in Science?

Item	Reason	Strongly Disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly Agree
1	My past Science failures tell me that I will continue to fail again and again.	1	2	3	4	5	6
2	There is not much I can do to improve my Science marks.	1	2	3	4	5	6
3	I will fail in Science even if I try harder.	1	2	3	4	5	6
4	I cannot do anything to improve my Science work.	1	2	3	4	5	6

Question 3

In my Science study, …

Item	Statement	Strongly Disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly Agree
1	I try to do well on my Science work.	1	2	3	4	5	6
2	I always try to do Science work better everyday.	1	2	3	4	5	6
3	I enjoy answering difficult Science problems.	1	2	3	4	5	6
4	I work hard to master difficult ideas in Science.	1	2	3	4	5	6

Question 2

Can I improve my experience in Science?

Item	Reason	Strongly Disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly Agree
1	My past Science failures tell me that I will continue to fail again and again.	1	2	3	4	5	6
2	There is not much I can do to improve my Science marks.	1	2	3	4	5	6
3	I will fail in Science even if I try harder.	1	2	3	4	5	6
4	I cannot do anything to improve my Science work.	1	2	3	4	5	6

Question 3

In my Science study, …

Item	Statement	Strongly Disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly Agree
1	I try to do well on my Science work.	1	2	3	4	5	6
2	I always try to do Science work better everyday.	1	2	3	4	5	6
3	I enjoy answering difficult Science problems.	1	2	3	4	5	6
4	I work hard to master difficult ideas in Science.	1	2	3	4	5	6

Question 4

How do I feel about Science?

Item	Statement	**Strongly Disagree**	**Disagree**	**Somewhat disagree**	**Somewhat agree**	**Agree**	**Strongly Agree**
1	I feel good about my Science work.	1	2	3	4	5	6
2	I enjoy my Science lessons.	1	2	3	4	5	6
3	There are many interesting things in Science.	1	2	3	4	5	6
4	I don't feel happy about my Science work.	1	2	3	4	5	6
5	My Science lessons are boring.	1	2	3	4	5	6
6	I'm not interested in Science.	1	2	3	4	5	6
7	When I do badly on the Science test, it is because I am not interested in the topic.	1	2	3	4	5	6

Question 5

How do I want to be seen in the Science class?

Item	Statement	**Strongly Disagree**	**Disagree**	**Somewhat disagree**	**Somewhat agree**	**Agree**	**Strongly Agree**
1	I want to get higher Science marks than my classmates.	1	2	3	4	5	6
2	I want to show my classmates that I am clever.	1	2	3	4	5	6
3	I try to bring honour to my parents by working hard in Science.	1	2	3	4	5	6
4	I try to please my teachers by doing well on my Science work.	1	2	3	4	5	6

Section B

Use pencil only. Please tick [√] the appropriate boxes:

1. Your gender: Boy ☐ Girl ☐

2. Your year of birth: 1986 ☐ 1987 ☐ 1988 ☐ 1989 ☐ 1990 ☐
1991 ☐ 1992 ☐ 1993 ☐ 1994 ☐ 1995 ☐

Your month of birth: Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐
July ☐ Aug ☐ Sept ☐ Oct ☐ Nov ☐ Dec ☐

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4. Education level of my parents:	**Father**	**Mother**
University	☐	☐
Post-secondary (e.g. Higher Diploma)	☐	☐
Secondary	☐	☐
Primary	☐	☐
Unknown	☐	☐

5. Type of occupation of my parents:		
Self-Employed / Owner	☐	☐
Professional (e.g. Manager, Teacher)	☐	☐
Technical (e.g. Computer technician)	☐	☐
Clerical (e.g. Clerk, Secretary)	☐	☐
Manual (e.g. Factory workers, Drivers)	☐	☐
Housewife / Homemaker	☐	☐
Retired	☐	☐
Unemployed	☐	☐
Unknown	☐	☐

8. Write down the number of brothers and sisters you have at home.

I am the only child at home. ☐

Older brothers: _____ Younger brothers: _____

Older sisters: _____ Younger sisters: _____

---

9. What kind of residential home do you live in: Privately Owned Housing ☐

Privately Rented Housing ☐

Public Estate Housing ☐

---

10 What language do you speak at home **most of the time**? Cantonese ☐

Mandarin / Chinese dialects ☐

English ☐

Japanese ☐

Other: _____

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11. Did you get a "Pass" grade for Science in your mid-term report card?

Yes, I passed Science. ☐ No, I did not pass Science. ☐

12. a) What letter grade did you get for Science in your mid-term report card?

A ☐ B ☐ C ☐ D ☐ E ☐ F ☐

OR

b) What was your mark for Science in your mid-term report card?

90 to100 ☐ 80 to 89 ☐ 70 to79 ☐ 60 to 69 ☐

50 to 59 ☐ Less than 50 ☐

- THE END -

Appendix IV

問卷指示

請不要在此問卷上填寫姓名。

本問卷旨在了解你對科學科目的學習態度和表現。請注意，下述各題都沒有正確答案，你只需填答自己的想法。若需要幫助，請舉手。

第一部份：

請細閱每條問題，然後請按照你同意或不同意的程度，圈上適當的數目字。越接近 1 ，表示你非常不同意。越接近 6，表示你非常同意。

第二部份：

請細閱每條問題，然後在適當的空格內填上「√」號。

第一部份

請仔細閱讀以下每一個句子，然後決定請圈上適當的數目字。越接近 1，表示你非常 不同意。 越接近 6，表示你非常同意。

問題 1

對我來說，科學科有多難？

項目	見解	非常不同意	不同意	頗為不同意	頗為同意	同意	非常同意
1	我可以完全發揮這個學年在科學課所學的知識。	1	2	3	4	5	6
2	如果我努力，可以完成更多與這科有關的難題。	1	2	3	4	5	6
3	若我不放棄，可以完成大部份科學的作業。	1	2	3	4	5	6
4	不管多難，我仍會繼續學習科學。	1	2	3	4	5	6
5	我喜歡自己找出做科學功課的方法。	1	2	3	4	5	6
6	科學考試的時候，我覺得很緊張。	1	2	3	4	5	6
7	我很難集中精神做科學功課。	1	2	3	4	5	6
8	許多科學課題對於我來講都太難了。	1	2	3	4	5	6
9	科學的功課那麼困難，我想我要放棄了。	1	2	3	4	5	6
10	我發覺要有效地編排讀書時間是很困難的。	1	2	3	4	5	6

問題 2

評估自己可以改善在科學科的體驗。

項目	原因	非常不同意	不同意	頗為不同意	頗為同意	同意	非常同意
1	過往的經驗，令我覺得自己在科學科不會取得好成績。	1	2	3	4	5	6
2	我覺得自己在科學方面，沒有甚麼可以改善。	1	2	3	4	5	6
3	即使我再加努力，仍是不會及格的。	1	2	3	4	5	6
4	我無辦法去改善科學的功課。	1	2	3	4	5	6

問題 3

我在科學這科的學習情況。

項目	見解	非常不同意	不同意	頗為不同意	頗為同意	同意	非常同意
1	我儘量做好科學科的功課。	1	2	3	4	5	6
2	我克服科學科困難，不斷努力。	1	2	3	4	5	6
3	我樂於為科學困難的問題找答案。	1	2	3	4	5	6
4	我喜歡做艱深的工作，因為我喜歡挑戰。	1	2	3	4	5	6

問題 4

我對自己在科學科的表現。

項目	見解	非常不同意	不同意	頗為不同意	頗為同意	同意	非常同意
1	我對自己在科學科的表現感到自豪。	1	2	3	4	5	6
2	我喜歡上科學課。	1	2	3	4	5	6
3	這科有許多令我感興趣的東西。	1	2	3	4	5	6
4	我覺得自己在這科的表現不佳。	1	2	3	4	5	6
5	我覺得上科學堂通常都是很沉悶的。	1	2	3	4	5	6
6	我對科學不感興趣。	1	2	3	4	5	6
7	當我的科學成績差，是因為我對一些課題不感興趣。	1	2	3	4	5	6

問題 5

上科學課堂時，我希望別人怎樣看我？

項目	見解	非常不同意	不同意	頗為不同意	頗為同意	同意	非常同意
1	我希望科學科成績比其他同學好。	1	2	3	4	5	6
2	希望別人覺得我聰明。	1	2	3	4	5	6
3	我努力學這科，因為想給父母帶來榮耀。	1	2	3	4	5	6
4	我努力學習科學，希望取悅老師。	1	2	3	4	5	6

第二部份

請細閱每條問題，然後在適當的空格內填上 √ 號。

1. 性別: 男 ☐ 女 ☐

2. 出生年份: 1986 ☐ 1987 ☐ 1988 ☐ 1989 ☐ 1990 ☐
1991 ☐ 1992 ☐ 1993 ☐ 1994 ☐ 1995 ☐

出生月份: 1 月 ☐ 2 月 ☐ 3 月 ☐ 4 月 ☐ 5 月 ☐ 6 月 ☐
7 月 ☐ 8 月 ☐ 9 月 ☐ 10 月 ☐ 11 月 ☐ 12 月 ☐

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4. 父母教育程度 :	父親	母親
大學程度	☐	☐
中學以上 (例子: 高級文憑)	☐	☐
中學程度	☐	☐
小學程度	☐	☐
不知道	☐	☐
5. 父母職業類型 :		
自顧人士 / 老闆	☐	☐
專業人士 (例子: 經理，教師)	☐	☐
技術人員 (例子: 電腦技術員)	☐	☐
文書工作 (例子: 書記，秘書)	☐	☐
體力勞動工作 (例子: 工廠，司機)	☐	☐
家庭主婦	☐	☐
退休	☐	☐
失業	☐	☐
不知道	☐	☐

6. 請填上家庭人數。

你有多少個兄弟姐妹?_____

你是否獨生子 / 女?　　是 ☐　　否 ☐

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7. 你的住所類型:

自置私人樓宇 ☐

租住私人樓宇 ☐

公共屋邨 ☐

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8. 你在家中最常用的語言

廣東話 ☐

國語 / 其他方言 ☐

英語 ☐

日語 ☐

其他: _____

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9. 你在期中試，科學科是否及格?

及格 ☐　　不及格 ☐

10. a) 取得哪個等級呢?

A ☐　　B ☐　　C ☐　　D ☐　　E ☐　　F ☐

或

b) 取得多少分?

90 to100 ☐　　80 to 89 ☐　　70 to 79 ☐　　60 to 69 ☐

50 to 59 ☐　　少過 50 ☐

-本問卷完 -

Informed Consent Form

I _____ (student's name) hereby agree to participate in the study entitled "Motivation and Achievement in Science" conducted by Ms. M. L. Chan. I understand that the purpose of this study is to investigate the relationship of motivation and achievement in Science in the junior secondary Chinese students in Hong Kong.

I confirm that my participation is solely voluntary. No coercion of any kind has been employed to obtain my cooperation. I have been notified of the procedures that will be applied in the study and know what will be required of me as a sample subject. None of the identifying information, including school and student names, will be used. I understand that I may withdraw my consent or participation at any time during this study. I have been informed that all of my responses will remain entirely anonymous and confidential. I acknowledge that I have received a copy of the Informed Consent Form, and wish to give my voluntary cooperation as a participant.

Ms. Chan will answer any further questions regarding this study by contacting her at m.l.chan@durham.ac.uk .

Student's Full Name: _____

Student's Signature: _____

Date: _____